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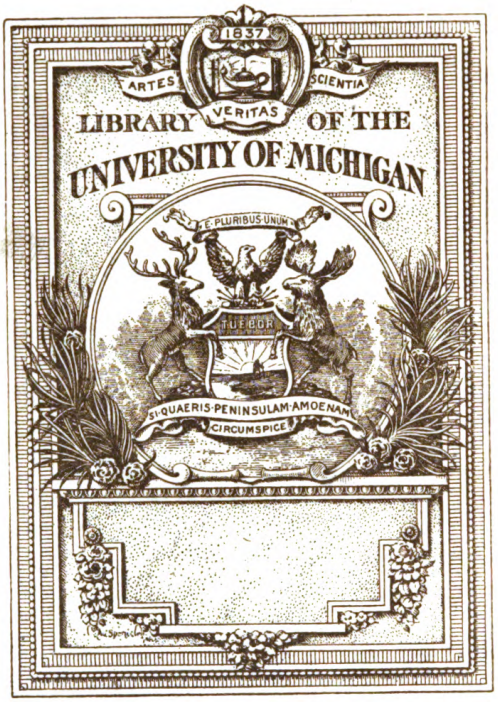
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TROPICAL VETERINARY BULLETIN

ISSUED UNDER THE DIRECTION OF THE HONORARY MANAGING COMMITTEE OF THE TROPICAL DISEASES BUREAU.

General Editor:
THE DIRECTOR OF THE BUREAU.

VOL. 2.

JANUARY—DECEMBER, 1914.

London:
TROPICAL DISEASES BUREAU,
Imperial Institute, S.W.

Sold by BAILLIÈRE, TINDALL & COX,
8, Henrietta Street, Covent Garden, W.C.

1914.

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ERRATA.

No. 4, p. 181, lines 3 and 4 : the word "resistant" should precede the word "and."

p. 183, para. 3, line 5 : for 1–10 cc. read 1·1 cc.

TROPICAL DISEASES BUREAU.

TROPICAL VETERINARY BULLETIN.

VOL. 2.] 1914. [No. 1.

BABESIASIS (PIROPLASMOSIS) AND ANAPLASMOSIS.

(1) SERGENT (Ed.), LHÉRITIER (A.), & ISMERT (R.). **Études sur les Piroplasmoses en Algérie. 1. Sur la Piroplasmose équine en Algérie. Guérison par le Trypanbleu.** [The Piroplasmoses in Algeria. 1. Equine Piroplasmosis. Recovery after Treatment with Trypanblue.]—*Bull. Soc. Path. Exot.* 1913. Oct. Vol. 6. No. 8. pp. 571–572.

This disease was first recognized in Algeria by ROGER in 1906. In 1913 the authors found a case on a farm near Algiers in a 14-year-old horse which had not left the premises for seven years.

The first symptom, consisting of oedema of dependent parts, was first seen on June 15th, and an examination of the blood six days later showed that 4 per cent. of the blood corpuscles were invaded by piroplasms. A subcutaneous injection of 5 grammes of trypanblue was given on the same day.

On the following day the animal was in about the same condition and an examination of the blood shewed that about 1 per cent. of the corpuscles contained parasites. A second dose of 5 grammes of trypanblue was administered intravenously.

Two days later there was considerable improvement in the animal's condition. The number of invaded corpuscles had fallen to about 0·3 per cent., and many of the parasites appeared to be degenerating.

By June 25th parasites seemed to have entirely disappeared from the peripheral blood, and recovery was complete a few days later.

Bovine piroplasmosis is known to exist in the district, but no case of the equine disease has been recorded previously.

(2) SERGENT (Ed.) & BEGUET (M.). **Études sur les Piroplasmoses d'Algérie. 2. Existence d'*Anaplasma marginale* Theiler chez les Boeufs d'Algérie.** [The Existence of Anaplasmosis in Cattle in Algeria.]—*Bull. Soc. Path. Exot.* 1913. Oct. Vol. 6. No. 8. pp. 573–574.

The authors have examined a large number of blood preparations made from cattle shewing symptoms of piroplasmosis, obtained from a number of different districts, and have discovered anaplasma in three of them.

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In one instance the blood of an animal shewing symptoms of piroplasmosis was found to contain anaplasma, 8 per cent. of the corpuscles being invaded. No piroplasms were found.

In the second case five animals were found to be infected, the percentage of infested corpuscles varying from 4 to 70. In this case also no piroplasms were found.

In the third instance the number of invaded corpuscles was 15 per cent.

In every instance there was polychromatophilia, metachromasia, and anisocytosis.

(3) Sergent (Edm.), Lhéritier (A.), & Boquet (A.). **Études sur les Piroplasmoses en Algérie. 3. Essais de Traitement de la Piroplasmose Bovine par le Trypanbleu.** [The Treatment of Bovine Piroplasmosis by Trypanblue.]—*Bull. Soc. Path. Exot.* 1913. Nov. Vol. 6. No. 9. pp. 618–622.

The authors state that, while the symptoms of Algerian bovine piroplasmosis will be discussed in a future paper, certain cases have been encountered which present a typical picture of the disease from a clinical standpoint, but in which piroplasms are either very scantily present in the blood, or quite absent. The diagnosis is justified by the clinical features presented and by the presence of other cases in which the parasite can be discovered. Further evidence is afforded by the exclusion of other diseases.

The cases described are divided into two main classes, viz., those in which the injection of the dye has appeared to be of some value, and those in which it has been valueless.

The first group contains mild or moderately severe cases, and the latter the severe cases. Of these there are three types, those in which piroplasms are very numerous in the blood, cases in which they are scanty, and cases in which no parasites can be found.

No description of the parasite is given in this paper, but mention is frequently made of small ring and bacillary forms, and, further, in one instance it is said that 95 per cent. of the red corpuscles were invaded. From this it appears to be not improbable that the author was dealing with a disease of the East Coast Fever type. Haemoglobinuria is said to have occurred in one case only, but it is not specified in what form of the disease this occurred.

Even in cases in which the injection of the drug has appeared to be beneficial the temperature did not fall for several days after. No alteration in the morphology of the parasite has been observed as a result of the injection of the dye.

(4) Sergent (Edm.), & Lhéritier (A.). **Études sur les Piroplasmoses en Algérie. 4. Infection piroplasmique intense chez des Bovidés ne présentant aucun Symptôme morbide.** [Heavy Infection with Piroplasms in Cattle shewing no Symptoms of Disease.]—*Bull. Soc. Path. Exot.* 1913. Nov. Vol. 6. No. 9. pp. 622–623.

The authors have made frequent examinations of the blood of a number of Breton cattle during a period of several months dating from their arrival in Algeria.

At the time of their arrival examination of the blood shewed no parasites, but during the summer following parasites were found to be present in the blood, in some cases in large numbers.

A table is given shewing the percentage of infected corpuscles found in nine animals which were examined about once a month during the year. In six instances during the months December 1911 and April 1912 parasites were found in 0·05 per cent. of the blood corpuscles, but in July 1912 the number varied from 1 per cent. to 80 per cent. During this month eight of the animals were affected, and the ninth had shewn 7 per cent. of infected corpuscles during June. Towards the end of July the number had fallen again. According to the record given only two animals were examined on this occasion, and 2 per cent. of invaded corpuscles were found in one of them.

The only description given of the piroplasms is that they were small, and round or bacilliform.

(5) CHAMBERS (F.). **Immunisation of imported Cattle against Northern Rhodesia Piroplasmosis and Anaplasmosis.**—*Jl. Comp. Path. & Therap.* 1913. Sept. Vol. 26. No. 3. pp. 249–253.

After noting the results obtained by THEILER and BEVAN the author gives the history of two imported bulls which he inoculated against the two diseases. It was the author's intention to inoculate them with a strain of anaplasma (*centrale* variety) obtained from Pretoria, but owing to loss in the post he was unable to do so. The animals on arrival were quarantined and were kept as free as possible of ticks; only eight of the *decoloratus* variety being found on them. On the 18th day they were inoculated subcutaneously with 25 cc. of citrated blood taken from an ox brought down from Barotseland a short time previously. Both animals contracted babesiasis (redwater) and one was given an injection of trypanblue. The subsequent anaplasmosis reaction was more severe in this animal than in the other. The anaplasmosis reaction caused considerable constitutional disturbance in both animals, but treatment with quinine and iron was resorted to and both made good recoveries. They were forwarded to the owner on the 34th day after inoculation.

(6) TRAUTMANN (O.). **Anaplasmosis der Schafe in Deutsch-Östafrika.** [Anaplasmosis of the Sheep in German East Africa.]—*Berlin. Tierärzt. Wochenschr.* 1913. Aug. 14. Vol. 29. No. 33. pp. 593–594.

The author claims to be able to confirm SCHELLHASE'S observations regarding the occurrence of this disease, and states that he observed it two years ago, though he was at the time unable to carry his investigations through.

He states that the disease has a wide distribution in Kondoa-Irangi. Young animals are principally attacked. The symptoms are:—A greenish-yellow discharge from the eyes and nose, progressive wasting, and in some cases diarrhoea. As the wasting progresses there is observed oedema of dependent parts. The disease sets in during very dry seasons and tends to disappear with the onset of the rains.

Examination of the blood shews the presence of a marginal anaplasm with a morphology exactly resembling that described by THEILER and SIEBER.

The usual abnormalities are to be observed in the blood and the lesions are those of an acute anaemia.

(7) DESCAZEAUX (M. J.). **Considerations étiogèniques, pathogèniques et therapeutiques sur la Piroplasmose des Bovidés dans l'Etat de Saint Paul.**—*Recueil de Méd. Vét.* 1913. Nov. 30. Vol. 90. No. 22. pp. 392–410.

Piroplasmosis in bovines in Saint Paul is invariably due to *Piroplasma* (*Babesia*) *bigeminum*, although CARINI has described the occurrence of *P. argentinum* in an imported animal.

The disease occurs in all parts of the country, and has been responsible in some instances for a mortality of 95 per cent. in imported animals. Adult animals are more susceptible than young ones. The transmitting tick is *Margaropus annulatus* var. *australis*. The author gives a detailed description of both sexes of this parasite.

Piroplasms are to be found in experimental cases at the seat of inoculation from the third or fourth day, although they do not appear in the circulating blood until the 7th or 8th day. These parasites are small and rounded and are often extra-corpuscular.

It is said that in cases of natural infection piroplasms can be found in blood taken from the ears before they appear in the general circulation, the explanation being that the infecting ticks are commonly found on the ears and the parasites found there are those injected by the tick before the circulation becomes invaded. It is also stated that this explains why intravenous injection of trypanblue is more effective than subcutaneous injection in natural cases of the disease.

In the treatment of the disease with this drug the author has had four deaths out of 15 natural cases and none out of 60 experimental infections. The drug is said to be more efficient when it is injected close to the seat of inoculation.

Auto-agglutination of the red corpuscles occurs before piroplasms can be detected in the blood, and becomes very marked when piroplasms are numerous.

The effect of trypanblue is to act directly upon the parasites and to cause very marked phagocytosis.

It is said that this phagocytosis is observed in animals that have been immunised against piroplasmosis, treated with trypanblue and immediately infected with anaplasma.

Parasites disappear from the blood about 20 hours after the injection of trypanblue, but they always reappear as small round bodies during the 10 to 20 days following recovery.

(8) CARPANO (M.). **Piroplasmose equina, Typi parassitari.** [Equine Piroplasmosis. The Types of the Parasites.]—*La Clinica Veterinaria.* 1913. Oct. 15/30. Vol. 36. No. 19/20. pp. 847–886. With 3 plates.

The author records the occurrence in Italy of the two types of parasites that are responsible for this disease and which have been encountered in other parts of the world. He has been able to satisfy

himself that they are distinct since he has found that animals immune to one are susceptible to infection with the other. A large proportion of native Italian horses appear to be immune to piroplasmosis, possibly as a result of infection while foals.

Clinically there does not appear to be much difference between the two types of infection, save that *Babesia caballi* appears to be responsible for more chronic cases than *Nuttallia equi*, which is the cause of more deaths. The immunity lasts for a considerable time.

The transmitting agent is *Rhipicephalus bursa*, and *Boophilus annulatus* appears to be capable of transmitting Babesia only.

(9) DARLING (S. T.). **Equine Piroplasmosis in Panama.**—*Jl. Infectious Diseases.* 1913. Sept. Vol. 13. No. 2. pp. 197–202. With 1 plate.

In this paper the author describes the occurrence of a case of equine piroplasmosis at Ancon.

The animal in question was one of the first to be sent to the Canal Zone in 1904. In January 1913 it was taken to Old Panama and the Juan Diaz River, and while there was allowed to graze on the Sabannas where there were some native ponies. Four days later the animal was found to be ill with an elevated temperature. The pulse and respiration were accelerated, and after an illness lasting three days the horse died.

At the post-mortem the following lesions were found :—

No subcutaneous oedema or fluid in the serous cavities. The anterior surface of the liver shewed a number of purplish areas of necrosis measuring up to rather more than an inch in diameter and with yellow centres. None were found in the substance of the liver. The spleen was enormously enlarged, and its pulp was dark in colour and rather fluid. Its weight was estimated at 28 pounds. The blood was somewhat more fluid than normal, and on microscopic examination there appeared to be some amount of leucocytosis, with a predominance of transitional and mononuclear forms. The parasite found was that described by NUTTALL and STRICKLAND as *Piroplasma* (*Babesia*) *caballi*; parasites were scanty in the blood. Ticks removed from the horse at the time of death were identified by NUTTALL and WARBURTON as *Dermacentor nitens* and *Amblyomma cajannense.*

(10) LAVERAN (A.) & NATTAN-LARRIER. **Piroplasmoses Canines d'Europe et d'Afrique.** [The Canine Piroplasmoses of Europe and Africa.]—*Ann. Inst. Pasteur.* 1913. Sept. Vol. 27. No. 9. pp. 701–717.

This paper contains a description of the experiments undertaken with the object of deciding whether the European and African canine piroplasmoses are identical or not.

The strains used were a French strain and a strain from Cape Colony. In order to attenuate the virulence of the piroplasms somewhat, the blood used for inoculation was placed in an ice chest for from three to seven days before it was used.

French virus. The period of incubation varied from two to five days, and of 23 dogs inoculated eight failed to become infected.

Two forms of the disease are distinguished, an acute and a sub-acute.

The acute form was most frequently seen, particularly after the second passage. Piroplasms appeared in the blood in from two to four days and death took place in from one to four days later.

In the subacute form of the disease crises occurred in from four to seven days after the appearance of parasites in the blood, and in some cases there were relapses at varying intervals afterwards. As a rule the parasites were very scanty during the relapses. Jaundice was observed in two cases only, but Gmelin's reaction was obtained with the urine containing haemoglobin in every instance.

Haemoglobinuria occurred in every dog that contracted the disease fatally, while in no case was it observed where the animal recovered.

In the acute form there are three constant lesions: anaemia, enlargement of the spleen, and congestion of the kidneys.

African virus. This virus, which was obtained from NUTTALL, was derived from a chronic case of the disease. As in the case of the French virus the inoculations were all intramuscular.

During the first five passages the period of incubation varied from 6 to 14 days, but subsequently it was reduced to 4 or 5, reaching 7 days in one instance only, when the blood had been kept in the ice chest for more than a week.

Excluding two cases in which the course of the disease was sub-acute, the average duration of the disease was 12 days, death occurring on the third day after the appearance of parasites in the blood.

Two dogs failed to become infected.

The acute form of the disease was most frequently observed, this type of infection occurring in two-thirds of the cases subsequently to the fourth passage.

The disease ran a sub-acute course in three cases only, and in two of these was followed by recovery. In these two cases the dogs were fairly old and one of them failed to become infected by the first inoculation. The second of these animals was inoculated with blood that had been preserved on ice for 10 days.

In almost every case in which the animals suffered from an acute attack of the disease there was observed haemoglobinuria, but jaundice was noted in one instance only. Bile was detected in the urine in 7 cases.

The lesions found were the same as those observed in the animals infected with the French virus.

Examination of the records shews that the only difference to be observed between the results of inoculation with the two viruses is that the African virus appears to be the more virulent. Upon these grounds cross-immunity experiments were undertaken. None of the dogs which had recovered either from the French or the African disease became infected when re-inoculated with the same strain. A bitch which had survived inoculation with both strains whelped, and one of the puppies inoculated immediately after birth with the French strain failed to become infected, while another inoculated 13 days after birth with the African strain contracted a fatal infection. The authors conclude from this that there is an immunity immediately after birth which soon disappears. In two instances the authors have shewn that the piroplasm does not pass from the mother to the foetus.

In the cross-immunity experiments dogs which had resisted infection with either strain were re-inoculated with the same strain 10 days

later, and then again inoculated with the other strain after a lapse of a further period of about ten days.

Details of these inoculations are given, and the results shew that of 7 dogs which had acquired immunity to the French strain 6 died of the disease when inoculated with the African strain, and 2 which had acquired immunity to the African strain suffered from a slight attack when inoculated with the French strain.

The authors conclude that these experiments shew a marked difference between the two strains. They point out that, if the difference was one of degree of virulence only, the immunity conferred by recovery from the disease caused by the French strain would cause the attack produced by the African strain to be of a mild character, whereas the contrary proved to be the case. Further, recovery from the African disease should confer absolute immunity against the French form of disease. This was also found not to be the case.

They conclude that the African parasite, if not a distinct species, is at least a variety distinct from the French parasite.

(11) KNUTH (P.) & RICHTERS (E.). **Ueber die Vermehrung von *Piroplasma canis* auf künstlichen Nährböden.** [The Cultivation of *Piroplasma* (*Babesia*) *canis* in Artificial Culture Media.]—*Zeitschr. f. Infektionskr. parasit. Krankh. u. Hyg. d. Haust.* 1913. Sept. Vol. 14. No. 2/3. pp. 136–144. With 2 plates.

While passing under rapid review the literature regarding the cultivation of malarial parasites and piroplasms, the authors state that their own experiments were commenced in February 1913 and were carried out independently of ZIEMANN.

Owing to differences in the characters possessed by piroplasms as compared with those of malarial parasites of man the authors have not closely adhered to the technique described by BASS and JOHNS. They point out that while piroplasms can under certain circumstances retain their vitality outside the body for a long time, the malarial parasites rapidly die, and also that the processes of multiplication of the two types of organism in the blood are very different.

It is laid down that in order to get successful cultures it is essential that there shall be only a small number of parasites present in the blood used, for if piroplasms are numerous the vitality of the organism is lowered and large quantities of inhibiting substances are present in the blood.

In order to get suitable blood it is advised that a young dog, from four to eight weeks old, should be inoculated, and if only old dogs are available for experiment, splenectomy should first be performed, and after a day or two 40 to 50 cc. of blood should be withdrawn in order to produce a temporary anaemia.

Repeated estimations have not shewn that piroplasms are more numerous in arterial blood than in venous blood, or vice versâ. Blood is withdrawn from the jugular vein and mixed with half its volume of 1 per cent. dextrose solution. The mixture is defibrinated and centrifuged, the serum and leucocytes being pipetted off. The tubes are then incubated at 40° to 41° C. Multiplication occurs during the first eight hours, and numerous, pear-shaped, elongated, and amoeboid intracorpuscular forms are to be found. Extracorpuscular forms

may also be encountered. Both the corpuscles and the parasites begin to degenerate by the 20th to 24th hour.

Subsequently certain alterations were made in the technique. The serum was not removed, a 2 or 3 per cent. solution of dextrose was used, and 1/10 cc. of 2 per cent. citrate solution was added to 5 cc. of blood. The best results were obtained when the tubes were left at room temperature, multiplication being observed up to the 6th or 8th day.

Numerous other media were tried, and ascetic fluid mixed with serum inactivated at 45° C. for an hour (proportions not stated) was found to be a good medium.

Subsequently the proportion of dextrose was increased, 1/10 cc. of a 50 per cent. solution being added to 6 cc. of blood.

Subcultures were obtained in media of composition similar to those used for the primary cultures, and it was found that the best results were obtained when the secondary cultures were made on the second or third day.

It was found possible to inoculate dogs successfully with sub-cultures and also to cultivate the piroplasms from dogs so infected.

(12) Toyoda (H.). **Züchtungsversuche mit *Babesia canis* nach der Bassschen Methode.** [The Cultivation of *Babesia canis* by Bass's Method.]—*Centralb. f. Bakt.* 1. Abt., Orig. 1913. Nov. 26. Vol. 72. No. 1/2. pp. 76–81. With 1 plate.

The author has succeeded in obtaining cultures in the following manner:—

Tubes were prepared containing the following mixture: 10 cc. of serum from a healthy dog, 0·2 cc. of 50 per cent. dextrose solution, 0·3 cc. of 2 per cent. sodium citrate in 0·85 per cent. sodium chloride. These tubes were inactivated by incubation at 45° C. for an hour.

The blood used as seed material was treated in the following manner. Blood in which parasites had just made their appearance was withdrawn from a vein and defibrinated, and then mixed with the same materials as the healthy serum and in the same proportions. The tubes were centrifuged, and after removal of the serum and leucocytes the corpuscles were added in the proportion of 0·4 to 0·5 cc. to the tubes of serum previously prepared.

In the subcultures 0·4 cc. of freshly prepared corpuscles from a healthy dog was mixed with 0·1 cc. of the "culture-blood," the mixture being incubated at 37° C.

Details are given of a particular case from which the following particulars are taken:—

The seed material (infected blood) which was used was examined microscopically, and in 50 fields (magnification not given) 6 parasites were found. In other preparations of the same blood several parasites which had divided into 2, 4, and 8 were found. The cultures were maintained for the first 18 hours at 37° C. and then for 6 hours at room temperature, this alternation of temperature being continued.

After 18 hours parasites were found at four places in 50 fields and they shewed from 6 to 8 merozoites, the total number observed being 25.

On the second day 46 merozoites were found in 50 fields, some of them being in groups of 16. The parasites shewed an increase in size, and in many instances one end was drawn out into a fine point.

On the third day the majority of the parasites were extracorpuscular and degenerated, but at one place 20 merozoites in a condition of partial degeneration were found in a single corpuscle.

No parasites were to be found on the 6th day.

The first subculture was made by inoculating fresh tubes from the primary culture at the 18th hour. It is not stated whether the alternation of temperature was used, but multiplication occurred as shewn by the examination of films. The multiplication was not so marked as in the primary culture and by the 4th day the majority of the parasites were degenerated.

The second subculture was made from the first at the 18th hour. After 18 hours incubation there appeared to be no multiplication, but after 48 hours at room temperature there was obvious multiplication. The cultures were then incubated at 37° C. for 18 hours and further multiplication occurred. Young schizogonous forms comprising only 2 or 4 merozoites were found, indicating that fresh blood corpuscles had been invaded.

Degeneration of the parasites occurred by the 5th day. No multiplication occurred in the third subculture.

THEILERIASIS.

(13) Nuttall (G. H. F.) & Hindle (E.). **Conditions influencing the Transmission of East Coast Fever.**—*Parasitology.* 1913. Oct. Vol. 6. No. 3. pp. 321–332.

The authors have made an attempt to confirm Gonder's account of the life cycle of *Theileria parva* within the invertebrate host, but they have been unable to detect in the tissues of infected ticks any appearances which could not be found in the corresponding tissues of clean ticks. More than 20 ticks have been submitted to thorough examination.

In order to throw more light upon the biology of the parasite in the tick, a number of experiments were undertaken to ascertain the effect of various conditions upon the infectivity of the ticks. Full protocols of the experiments are given and these afford the following information.

In the first experiments it was shewn that ticks do not necessarily become clean as a result of biting a vertebrate host, and further that an infected tick does not become infective until it has fed upon a bovine for at least two days.

Secondly it was shewn that infected ticks could be fed upon a rabbit for three days before being placed upon a susceptible animal, without losing their power of infecting the bovine. In the experiments given the period of incubation was exactly the same as that in the control animal, excluding the three days spent by the ticks upon the rabbit.

Infected ticks were placed upon a susceptible calf and were removed after they had been attached for two days. The calf did not become infected, but was proved subsequently to be susceptible to infection.

It being thought possible that the non-infectivity of the ticks during the first two days spent upon a bovine animal might in some way be connected with the temperature, unfed infective ticks were heated to 37° C. for two days before they were placed upon a susceptible animal,

but this did not render them infective during their first two days spent upon it.

The fifth experiment shewed that preliminary feeding of infective ticks for two days, followed by starvation for 17 days, rendered them non-infective.

Since experiments shewed that ticks are non-infective until after they have fed for two days, it appeared to be reasonable to suppose that the failure of attempts to infect cattle by the inoculation of ticks was owing to the inoculation of parasites at an unsuitable stage of development.

Two calves were inoculated respectively with the contents of 19 engorged ticks and the salivary glands of 18 infected ticks. Neither of these became infected, but the calf upon which they were fed became infected and died.

Some experiments were carried out to test the effect of cold upon the infectivity of *R. appendiculatus* infected with *T. parva*.

Engorged larvae after being kept for about five weeks at 19° C. were found to be infective after being warmed for a single night to 37° C.

Infected ticks were found to be non-infective after having been maintained at about 10° C. for three weeks. It was found that warming the ticks thus rendered non-infective restored their infectivity.

TRYPANOSOMIASIS.

(14) Bruce (David), Harvey (D.), Hamerton (A. E.), & Lady Bruce. **Trypanosomes of the Domestic animals in Nyasaland. I. *Trypanosoma simiae*, sp. nov. Part II.—The Susceptibility of Various Animals to *T. simiae*.—*Proc. Roy. Soc.* 1913. Oct. 1. Series B. Vol. 87. No. B. 592. pp. 48–57.**

The morphology of this parasite has been dealt with in a previous paper (see this *Bulletin* Vol. 1. No. 2. pp. 77–78); the present publication deals with the pathogenic range of the trypanosome.

The organism kills monkeys and the domestic pig in an extremely short time, but is non-pathogenic for cattle, antelope, dogs, and small experimental animals. The trypanosome is however capable of infecting the goat and the sheep.

So far as is known, the warthog is the only wild animal in the district which harbours it, and this animal is very numerously present in the low country. This explains why so large a number of infected flies are found.

The trypanosome undergoes a change of virulence with great rapidity. If a monkey and a goat be infected by means of flies, the monkey dies within a few days, but if an attempt be made to infect a monkey by inoculation with the goat's blood, the result is generally a failure.

"The organism belongs to the same group as *T. pecorum*, and it is curious that this loss of virulence occurs in the latter species also. . . . This has given rise to the erroneous idea that a separate species—*T. nanum*—exists. *T. nanum* is in truth nothing but a strain of *T. pecorum* which has lost its virulence for these animals (monkey, dog, rat) by its passage through the goat."

Tables are given shewing the results of a large number of experimental inoculations.

The following is an abstract of the summary of the results obtained :—

The opportunity has not yet been offered to test the effect of *T. simiae* upon equines. Four oxen have been inoculated, two from a monkey and two from a goat, and all have remained in good health. Five antelope have been inoculated without positive results, and the trypanosome has never been found in the blood of an antelope.

Thirty-one goats and one sheep have been infected. Passage through the fly would appear to exalt the virulence, or at least the trypanosome would appear to reach its highest virulence after passage through the fly. Of 15 goats infected by flies, 13 died in, on an average, 46 days. Three goats inoculated directly from warthogs all recovered ; this is curious, since in all probability the fly must get its infection from that species. Six goats were inoculated with blood from fly-infected monkeys. One died, four recovered, and one was refractory. Three goats out of six infected from goats died, the remainder recovering.

Of the cases of fly infection in the goat 12 were cases of mixed infection, but from the results obtained it would appear that *T. simiae* alone is as fatal as when mixed with other trypanosomes. The only symptoms presented by goats are emaciation, anaemia, and exhaustion.

In the domestic pig the disease runs a very rapid course. In nine experiments the average period elapsing between inoculation and death was 5·3 days.

When monkeys are infected directly from flies death takes place within a fortnight, and a similar result is obtained when monkeys are inoculated from other monkeys which have very recently been infected by the bite of flies. When a monkey is inoculated with the blood of an infected goat the result is generally negative.

The dog appears to be immune, as do the guinea-pig and rat. The rabbit presents a high degree of resistance.

The carrier is *G. morsitans ;* 3·4 per 1,000 were found to be infected. The reservoir of the virus appears to be the warthog. Of 33 examined three were infected.

(15) Bruce (David), Harvey (D.), Hamerton (A. E.), & Lady Bruce. **Trypanosome Diseases of Domestic Animals in Nyasaland. I. *Trypanosoma simiae*, sp. nov. Part III.**—*Proc. Roy. Soc.* 1913. Oct. 1. Series B. Vol. 87. No. B. 592. pp. 58–66. With 3 plates.

In this paper the development of *T. simiae* is described. The trypanosome belongs to the pecorum group. In this group development takes place in the intestinal tract, including the labial cavity of the proboscis, and afterwards the trypanosomes reach the hypopharynx, where they revert to the original blood or infective form.

Flies were found to become infective in 50 days at a temperature of 62° F. and in 20 days at 83° F.

By causing flies to salivate upon coverglasses the long narrow intestinal form of the organism was found, and there is no doubt that the fly has the power of regurgitating the contents of the proventriculus and intestine forwards into the labial cavity and probably into the blood stream.

Conclusions :—

" 1. That *T. simiae* can be transmitted from infected to healthy animals by the tsetse fly *G. morsitans*.

" 2. That *T. simiae* multiplies in the intestines and in the labial cavity of the proboscis of the fly. Here only developmental forms are found, never infective forms.

" 3. That *T. simiae* growing in the intestines of the " fly " has no specific characters by which it can be distinguished from other species of pathogenic trypanosomes found in tsetse flies.

" 4. That the final stage of the development takes place in the hypopharynx, wherein the infective form of the parasite, similar in shape to the trypanosome found in the blood of infected animals, is produced.

" 5. That the flies do not become infected until about 20 days after their first infected feed."

(16) Bruce (David), Harvey (D.), Hamerton (A. E.), & Lady Bruce. **Trypanosome Diseases of Domestic Animals in Nyasaland. III.** *Trypanosoma pecorum.—Proc. Roy. Soc.* 1913. Oct. 1. Series B. Vol. 87. No. B. 592. pp. 1–26.

This trypanosome has been found in cattle, wild game, and wild flies in the neighbourhood of Kasu, and it is one of the most important trypanosomes of domestic animals in Central Africa, since it affects horses, cattle, goats, sheep, pigs, and dogs. The morphology of the trypanosome has already been dealt with. The bulk of this paper is made up of tables of measurement of the trypanosome in various animals and charts constructed upon these. A comparison of the charts constructed upon the measurements of the parasite occurring in domestic cattle, wild game and wild *G. morsitans* shews that they are very similar. The measurements were taken from the parasites present in the blood of a number of different animals.

The cattle strain of the organism is fatal to goats in 30 to 40 days, but death does not appear to be the invariable result.

Dogs are certainly killed within 30 days. Guinea-pigs and white rats appear to offer an absolute resistance to infection.

The wild game strain produces the same effect upon the goat as the domestic cattle strain. The monkey offers a considerable resistance. Only three out of eleven monkeys died of the infection, the remainder never shewing trypanosomes at all. In these three animals the period of incubation varied from 9 to 27 days, and the duration of the disease from 88 to 236 days.

Nine goats and nine dogs were inoculated with the wild game strain, and while all the goats became infected, none of the dogs contracted the disease. Of nine rats inoculated with this strain four remained healthy and five died in about 30 days.

Experiments with the wild fly strain had the following results : A single ox sent into the " fly " country contracted a double infection of *T. pecorum* and *T. caprae*, and died in 140 days.

Flies brought up from the " low-country " were as a rule fed upon a goat, a monkey, and a dog. As the flies were often infected with several species of trypanosome, the result in many cases was one of mixed infection. In 50 experiments with goats, 10 were pure infections with *T. pecorum*. As *T. pecorum* is the most rapidly fatal trypanosome for the goat among those occurring in the district, it may be assumed that it was mainly responsible for death in the 28 cases in which the infection was mixed.

In eight feeding experiments with wild *G. morsitans* carried out with pigs, only two shewed a pure *pecorum* infection.

Only six monkeys out of 28 became infected with this strain.

The dog is about as susceptible as the goat, and death usually takes place in, on an average, 41 days.

The carrier of the infection is *G. morsitans*. The percentage of infected flies was found to be 0·46. This is given as the minimum, and it is said that the real proportion is probably about three or four times as great.

It is also stated that given an outbreak in a herd there is some evidence to shew that *Tabanidae*, *Haematopota*, and other biting flies may act as mechanical carriers. The evidence that Stomoxys plays a similar rôle is said to be unsatisfactory.

(17) Bruce (David), Harvey (D.), Hamerton (A. E.), & Lady Bruce. **The Trypanosome causing Disease in Man in Nyasaland.—Susceptibility of Animals to the Human Strain.**—*Proc. Roy. Soc.* 1913. Oct. 1. Series B. Vol. 87. No. B. 592. pp. 35–45.

The bulk of this paper is made up of tables shewing the results of experimental inoculation of different species of animals with trypanosomes derived from five human sources.

Ox. The trypanosome is not so deadly as *T. pecorum*. Of 13 animals inoculated only one died, after an illness lasting 134 days, four became infected, and the remainder proved refractory. The recovered animals are in good condition, presenting a contrast with animals recovered from *pecorum* infection.

Goat. Twenty-two animals were inoculated and all died. The duration of the disease varied from 19 to 72 days. One animal shewed swelling of the face, but none developed any opacity of the cornea.

Sheep. The infection runs about the same course in the sheep as in the goat, and the same fatal result is obtained. Of seven sheep inoculated three shewed marked swelling of the face.

Baboon. One was inoculated and proved refractory.

Monkeys. Twenty monkeys died in from 10 to 51 days. Trypanosomes were always present in their blood and were often very numerous. There was no oedema of the face, and no corneal opacity was observed.

Dog. Of 25 dogs inoculated all died in from 14 to 78 days. In eight of the animals there was oedema of the face and opacity of the cornea.

Rabbits. Seven died in from 15 to 42 days. The clinical picture of an infected rabbit is said to be exactly like that of one suffering from infection with nagana. There is swelling of the eyes, the face puffs up, and sores break out around the eyes and nose. The eyes become closed up and there is a purulent discharge from the nose. The ears become thickened and covered with sores.

Guinea-pig. These animals are more refractory than rabbits, and often require to be re-inoculated before they take the disease. Fifteen were used, and they died in from 12 to 114 days.

Rat. Twenty-one were inoculated and all died in from 13 to 93 days.

Among the conclusions drawn is the following :—

"It is not satisfactorily proved yet to what species this trypanosome belongs, but the Commission at present leans to the opinion that it is *T. brucei* (Plimmer and Bradford)."

(18) **Duke (H. L.). Some Trypanosomes recovered from Wild Game in Western Uganda.**—*Rept. of the Sleeping Sickness Commission of the Royal Society.* 1913. No. 14. pp. 37–59. With 4 plates and 1 map.

The tour of investigation dealt with in this paper was undertaken with the object of obtaining information regarding the part played by wild game in the spread of trypanosomiasis of human beings and domestic animals.

The area covered is divided roughly into four areas as follows :—

1. The north-west portion of Ankole.
2. Parts of the Toro Province from the northern bank of the Kazinga Channel to the Mahokya and Hima Rivers.
3. The Southern Toro Game Reserve, extending from the northern end of Lake George northwards nearly to Fort Portal.
4. The Semliki valley north of the Mboga road.

The characteristic topographical features and predominant game species of each of these districts are dealt with in some detail. A series of wild animals shot in districts where tsetse are not known to occur served as controls.

Blood from freshly killed animals was defibrinated and used for the inoculation of goats, this species being selected in order to include as many species of trypanosomes as possible. At the same time smears were taken for staining and fresh preparations were examined. The goats used were purchased in tsetse-free districts and were examined daily before use. No evidence of natural infection was found.

It was found impossible to set aside a goat for each species of game examined owing to the distances covered and the difficulties of transport.

Full details of every goat inoculated are given and it may be gathered that the following trypanosomes, or trypanosomes closely resembling them, were found :—*T. vivax*, *T. pecorum*, *T. uniforme*, a trypanosome very suggestive of *T. gambiense*, *T. nanum*, and a trypanosome belonging to the *brucei-pecaudi-gambiense* group.

Trypanosomes were found in the blood of one antelope only out of 39 animals of different kinds shot in districts known to be free of tsetse, but it is said that possibly this animal may at some time have reached the fly zone on Lake Victoria.

Of the 52 animals shot in the tsetse districts 10 were found to be infected with trypanosomes, while only one of those shot in the tsetse-free districts was found to be infected. Since tabanids, Haematopota, Muscidae, Chrysops, etc., are common to both districts, there can be no doubt regarding the significance of Glossina as a carrier of trypanosomes.

Details are given of a number of investigations carried out with wild Glossina.

Conclusions :—

" 1. A considerable portion of the wild game in the fly districts of the Western Province of the Uganda Protectorate is infected with trypanosomiasis.

" 2. Certain of these trypanosomes have suspicious resemblance to the human trypanosomes, *T. gambiense* and *T. rhodesiense*. Others are known to be exceedingly pathogenic to domestic animals.

" 3. The tsetse of these parts also contain flagellates which it is highly probable are derived from wild animals.

"4. The population of the fly districts is scanty, and the greater part has recently been moved to fly-free parts.

"5. It is reasonable to hope that, as regards the spread of human trypanosomiasis, the removal of the people from the infected districts will suffice, and this measure will simultaneously prevent native cattle being exposed to the fly bite. The majority of the fly area is practically uninhabited country.

"6. The alternative of destroying the game, and so of abolishing what is doubtless a permanent trypanosome reservoir, would be a gigantic and almost impossible undertaking in this region. In considering such a proposal elephant must, of course, be included, as must also hippo, situtunga, bush-pig and hyaena, all of which are difficult to eradicate. The scarcity of people is a serious objection to such a course, as is the difficult nature of the country. It would be well to await the trial of this expedient under more favourable conditions before undertaking so drastic a measure under severe natural handicaps.

"7. It would appear inadvisable to take any measures to protect the existing game and thereby encourage an increase in their numbers. On the other hand, it is inadvisable to permit natives to hunt in the fly districts. The ideal arrangement would be to make the fly districts prohibited areas, and in the region under consideration this is feasible to a far greater extent than would be the case in other parts of the Protectorate.

"Special attention must be directed to the Mahokya district in order to stamp out *G. pallidipes* from the immediate neighbourhood of the main road."

(19) Battaglia (M.). **Einige durch Trypanosomiasis Dromedarii erzeugte Läsionen.** [Lesions in the Dromedary caused by Trypanosomes.]—*Centralbl. f. Bakt.* 1. Abt. Orig. 1913. Oct. 4. Vol. 71. No. 2/3. pp. 182–184.

The author claims to have established the fact that this trypanosome multiplies by schizogony and sporogony. The parasite was obtained from Pricolo, who found it in a camel.

A rabbit was scarified with all possible aseptic precautions upon the prepuce with a hollow needle containing blood rich in trypanosomes. On the 4th day there was a hard, oedematous area at the seat of scarification, and by the 8th day there was scab-formation followed by ulceration and a hard granuloma. On the second day after scarification there were present in the blood intra- and extraglobular amoeboid forms of the parasite. On the 8th day, when true trypanosome forms were scantily present in the blood, rounded and pear-shaped forms were numerously present. Trypanosome forms were observed in large numbers in the lesions of the genital organs. There was oedema of the scrotum and orchitis.

In rabbits infection with this trypanosome runs a peculiar course. Infection occurs in whatever manner the animals are inoculated. During the first three days trypanosome forms are scantily present in the blood and after this they disappear although the blood remains infective. The animals gradually lose condition and die in from seven to eight months.

The local lesion of the genital organs is not developed if the inoculation is made at some other part of the body.

Rabbits and dogs sometimes shew keratitis.

(20) FAVERO (Francesco). **Su alcune Vie d'Introduzione del *Tripanosoma brucei*, considerate in Rapporto al Decorso dell'Infezione.** [On the Different Channels of Introduction of *Trypanosoma brucei*, considered in Relation to the Course of the Infection.]—*Clinica Veterinaria.* 1913. Nov. 30. Vol. 36. No. 22. pp. 996–1002, & Dec. 15. No. 23. pp. 1045–1054. With 1 chart.

The author, having set himself to discover what difference resulted from inoculating *Trypanosoma brucei* into different regions in dogs, found that the intensity of the resulting infection varied according to the seat of the injection, in the following order :—1, intra-thyroid, 2, intra-renal, 3, intravenous, 4, intra-urethral, 5, intra-testicular, 6, endo-peritoneal, 7, subcutaneous, 8, intra-medullary, 9, intra-splenic, and 10, into the anterior chamber of the eye. The results are exhibited in tabular form. The aqueous humour of the eye seems to have a distinctly attenuating effect upon *Trypanosoma brucei*, to judge from the mildness of the resulting infection.

The greater part of the paper is occupied with a discussion of the views of various authorities, and there is a copious bibliography at the end.

(21) GORETTI (G.). **Ricerche Sperimentali sul Nagana. III Comunicazione. Contributo allo Studio delle Alterazioni del Sistema nervoso centrale nell'Infezione sperimentale da Nagana (*Tripanosoma brucei*).** [Experimental Investigations regarding Nagana. III Communication. The Alterations in the Central Nervous System in Experimental Nagana (*T. brucei*).]—*Lo Sperimentale.* 1913. Nov. 13. Vol. 67. No. 5. pp. 527–564. With 2 plates.

The author's conclusions are as follows :—

In rabbits, guinea-pigs and dogs experimentally infected with *Trypanosoma brucei* (nagana) serious lesions are found in the central nervous system.

1. Marked chromatolysis of the cellular elements in general.
2. Moderate infiltration with plasma cells and lymphocytes in the membranes and around the capillaries of the central nervous system, similar cells being found free in the lumen of the vessels. Also a moderate scattering of " Stabchenzellen " in the nervous tissues, particularly in the case of dogs.
3. Diffuse lesions of the myeline fibres of the brain, some of the tracts of the cord, the bulb, pons, mesencephalon and of the roots of the spinal and cranial nerves. These alterations can be demonstrated by the methods of DONAGGIO and MARCHI.
4. More advanced bilateral lesions of the decussating pyramidal tracts may be demonstrable by WEIGERT'S method, and the posterior roots and posterior spinal tracts may also be involved.
5. A slight proliferation of the neuroglia.
6. The lesions are in part of a secondary nature and probably due to toxic products liberated by the trypanosomes. Such products have already been shown to have an injurious effect upon the central nervous system.

(22) PAPARCONE (E.). **Ricerche Sperimentali sul Nagana. IV Comunicazione. Lesioni oculari per Infezione generale da *Trypanosoma brucei*.** [Experimental Investigations regarding Nagana. IV Communication. Ocular Lesions in General Infection with *T. brucei*.]—*Lo Sperimentale.* 1913. Dec. 17. Vol. 67. No. 6. pp. 933–942. With 1 plate.

The experiments given in this paper were carried out with a very

virulent strain of the trypanosome, mice dying in three days after intraperitoneal inoculation. It was found that in mice and rats death occurred in so short a time that no ocular lesions visible to the naked eye were produced. Lesions were found in rabbits and dogs, which offered more resistance to the infection and consequently survived for a longer period after inoculation. In from a week to a fortnight these animals showed swelling of the eyelids and adjacent tissues and a scabby condition of the edges of the lids. There was also a more or less intense conjunctivitis with a variable amount of muco-purulent secretion. The infected rabbits and dogs, and particularly the latter, showed a parenchymatous keratitis of the cornea associated with iritis.

The conclusions drawn are :—

1. In dogs and rabbits experimentally infected with *T. brucei* lesions may be observed involving the tissues of the eye. Blepharitis, conjunctivitis, intense diffuse parenchymatous keratitis, irido-cyclitis, choroiditis, etc., may be seen.
2. The trypanosomes may be found in the conjunctival secretion and in the aqueous humour (in stained preparations and by animal inoculation).
3. They are demonstrable in the cornea in the earliest stages when it is still transparent and when the keratitis is intense. The interstitial lesions are due to the multiplication of the parasites in the parenchyma of the cornea and to their toxic products. It has been found possible to produce parenchymatous keratitis with extracts of trypanosomes.
4. As the aqueous humour contains trypanosomes, whatever the method of infection, so animals can be infected by inoculation into the anterior chamber of the eye.

(23) Bovone (E.) & Maja (A.). **Nota su di un Tripanosoma dei Bovini del Katanga.** [A Trypanosome of Bovines in Katanga.]—*Giorn. di Med. Vet.* 1913. Oct. 25. Vol. 62. No. 43. pp. 1033–1035.

The authors describe the occurrence of a large trypanosome in the blood of seven bovines on the Esschen Plateau. In fresh blood the parasite was exceedingly active, the movement involving translation. The nucleus was visible and appeared to be about the size of a red blood corpuscle, and the posterior portion of the body shewed a number of large granules. Although the centrosome could not be made out, it appeared to be placed near to the nucleus, and the undulating membrane and flagellum took origin from that situation. The parasite was very scantily present in the blood.

Only one stained preparation was available for examination and in this the parasite measured 60 microns in length by 5 in width. Both ends tapered to a marked degree. The authors think that the organism was *T. ingens*.

(24) Ferber (F.). **Beiträge zur Biologie der nur auf kulturellem Wege nachweisbaren Flagellaten des Rinderblutes.** [The Biology of the Culturally Demonstrable Flagellates of Ox Blood.]—*Zeitschr. f. Hyg. u. Infektionskrankh.* 1913. Dec. 12. Vol. 76. No. 2. pp. 193–207,

Multiplication of the parasites is inhibited either partially or completely at 37° C., and at 53° C. the parasites gradually die. Temperatures of 50° C. and lower for a period of 24 hours do not injure the vitality of the parasite.

The flagellate multiplies in broth prepared from various kinds of meat, but not in defibrinated blood or salt solution.

The parasite multiplies on faintly alkaline agar and on blood agar, and in blood broth whether the blood used for the medium is taken from an animal that has been infected or not.

In no stage of development can the flagellates pass Berkefeld filters.

It was found to be impossible to infect animals with cultures, as indicated by the non-appearance of trypanosomes in the blood and the absence of flagellates in cultures.

(25) Blacklock (B.) & Yorke (W.). ***Trypanosoma vivax* in Rabbits.** —*Ann. Trop. Med. & Parasit.* 1913. Dec. Vol. 7. No. 4. pp. 563–568.

The strain of *T. vivax* used in this series of experiments was that isolated by the authors from a horse from the Gambia (see this *Bulletin*, Vol. 1. No. 2. Abstr. No. 121. pp. 76–77). After the isolation of the parasite the strain was preserved by passage through goats, the number of passages up to the date of writing being 39. During this period there was observed no exaltation of virulence for the goat. The average duration of the disease during the whole period has been 30 days.

A number of attempts were made to infect rabbits from the goats of this series, but the inoculations failed or resulted in a transitory infection from which the animals recovered. From the 38th goat of the series, however, rabbits were successfully infected by intraperitoneal inoculation.

The period of incubation was 5 to 8 days, and of the four rabbits used two died, in 17 and 34 days and the other two recovered.

From these rabbits the strain has been carried on in others over a period of more than three months to the eighth generation. Goats have been successfully inoculated from rabbits. The strain has not proved to be invariably pathogenic for the rabbit, and many of them appear to have recovered, but the majority have certainly become infected.

Examination of the strain after passage through six generations in the rabbit shewed that the parasite as a rule did not exhibit the same degree of activity as in the goat, but there were no discoverable alterations of morphology.

(26) Mesnil (F.). **Sur le Nagana de l'Ouganda.**—*Bull. Soc. Path. Exot.* 1913. Dec. Vol. 6. No. 10. pp. 685–689.

After referring briefly to the litearture regarding the identity or otherwise of *T. brucei* Plimmer and Bradford and *T. brucei* (Uganda), the author gives details of some experiments carried out with the idea of throwing further light upon the question.

Three goats, two of which had been used for experimentation with other trypanosomes, were inoculated with the Uganda strain, the "ferox" (Ehrlich) nagana strain and the Zululand strain. The first and last of these died as a result of the inoculations. The goat inoculated with the "ferox" strain survived and apparently recovered, since its blood was non-infective for a dog. It received a second inoculation with the same strain and became reinfected. Before it had recovered from the second inoculation it was inoculated with

the Zululand strain of nagana. About six months after this inoculation its blood was negative when tested by the inoculation of dogs. After a further interval of six months it was again inoculated with the Zululand strain and failed to become infected, as shewn by the experimental inoculation of mice.

The author concludes that at this date the goat was immune to the Zululand strain.

Two months later it was inoculated with the Uganda strain, and succumbed to the infection after an interval of two months.

From this the author concludes that the Zululand strain is different from the Uganda strain, and this view is supported by the results obtained in some passive immunity experiments which are briefly referred to.

(27) Macfie (J. W. Scott) & Johnston (J. E. L.). **A Case of Equine Trypanosomiasis characterised by the Occurrence of Posterior Nuclear Forms.**—*Jl. Trop. Med. & Hyg.* 1913. Nov. 15. Vol. 16. No. 22. pp. 348–349. With 1 text figure.

The trypanosomes described in this short note were found in films of blood taken from a horse at Accra. Long slender and short stumpy forms were met with and in many cases the tropho-nucleus was situated in the posterior half of the body. In no instance was a trypanosome observed in which the tropho-nucleus was actually posterior to the kineto-nucleus, although in many it was touching it.

Following the procedure described by Blacklock the authors found that the nucleus was definitely posterior in 4·8 per cent. of all trypanosomes, except dividing forms, present.

As it was impossible to carry out any inoculation experiments the authors are unable to identify the parasite with certainty, but they state that a parasite with the same morphology is responsible for the death of a large number of horses in Northern Nigeria every year. Several specimens were identified by Bruce as *T. brucei*.

The author points out that, if *T. brucei* (*pecaudi*) is identical with *T. rhodesiense*, one would expect to find cases of human trypanosomiasis due to *T. rhodesiense* in places where *T. brucei* is common among the domesticated animals. This is not the case in Nigeria. Sleeping sickness there does not present the acute features observed in cases in Rhodesia. The disease is endemic, but by no means fatal.

One of the authors has recently studied the trypanosome from a case of sleeping sickness in Southern Nigeria, and it is stated that neither in its morphology, measurements, nor in its animal reactions does it resemble *T. brucei* (*pecaudi*) or *T. rhodesiense* (see below p. 25).

(28) Neiva (A.). **Multiplicaçao no Vinchuca (*Triatoma infestans* Klug) do Trypanosomo do Mal de Cadeiras.** [The Multiplication of the Trypanosome of Mal de Caderas in the Vinchuca.]—*Brazil Medico.* 1913. Sept. 15. Vol. 27. No. 35. pp. 366–367.

The author has been unable to find a correspondence in distribution between the capybara and mal de caderas, although it was suggested by Elmassian and Migone that that animal was the reservoir for the trypanosome. He has been able to infect the vinchuca experimentally

and has found that its faeces are infective for guinea-pigs when placed upon the conjunctiva. The period of incubation was 10 to 15 days.

It is suggested that flies of the genus Chrysops are more probably the transmitting agents than *Stomoxys calcitrans*, as suggested by SIVORI and LÉCLER.

(29) BLACKLOCK (B.) & YORKE (W.). **The Trypanosomes causing Dourine (Mal de Coït or Beschälseuche).**—*Proc. Roy. Soc.* 1913. Oct. 16. Series B. Vol. 87. No. B. 593. pp. 89–96. With 1 plate.

In this paper the authors record the results of their examinations of three strains of trypanosomes said to be the trypanosome of Dourine. The first of these was obtained from the Kaiserliches Gesundheitsamt, Berlin, and is said to have come originally from Algeria, the second from EHRLICH, the origin of which is unknown, and the third was the strain responsible for the outbreak of dourine in Eastern Prussia in 1905.

The biometrical method was adopted.

The authors find that the second and third strains closely resemble each other morphologically, while the first presents marked differences. The second and third belong to the group of trypanosomes in which all individuals have a free flagellum, while the morphology of the first strain does not enable them to distinguish it from *T. rhodesiense* or *T. brucei* Uganda.

They are conducting experiments to ascertain whether the strains are still capable of setting up the typical disease in equines. For the present they propose the name *T. equi* for the *rhodesiense*-like organism.

(30) BAUCHE (J.) & BERNARD (P. N.). **Notes sur le Surra d'Indo-Chine à Hué.**—*Bull. Soc. Path. Exot.* 1913. Dec. Vol. 6. No. 10. pp. 690–693.

The natural disease.—Equine trypanosomiasis in Annam has been differentiated from the surra of India by LAVERAN and MESNIL, by whom the causal trypanosome was named *T. annamense.* The disease exists in Annam as an enzootic among horses, cattle, buffaloes, and dogs. In a paper published by SCHEIN in 1907 the part played by cattle in forming the reservoir of the virus was emphasised.

The authors have examined the blood of 300 cattle at the slaughter-houses in apparent good health and have discovered trypanosomes by direct observation on six occasions. Eighty-nine buffaloes were examined with negative results. A single infected dog was found among 300 examined.

In two outbreaks which resulted in the death of 9 out of 48 and 100 out of 200, the horses were stabled near the cattle sheds. The batches of horses pastured near woods furnished the whole of those that became infected, while those that were pastured upon cleared land, going out only at night or on cool days when there was no sun, remained absolutely free from infection.

The average period of incubation was 11 days, and it was found possible to arrest an outbreak by taking daily temperatures, isolating

the animals shewing a febrile elevation and slaughtering them after a diagnosis by microscopic examination.

Experiments carried out with a variety of species of flies upon guinea-pigs failed.

Experimental inoculations.—It having been suggested by BALDREY that the pig might be the reservoir of surra, the authors examined the blood of about 2,000 pigs without discovering a single one infected. The trypanosome was found to be pathogenic for pigs, death taking place in from 10 to 75 days. Of a number of guinea-pigs inoculated from an infected dog the majority died in from three weeks to a month, and two monkeys died in 13 and 26 days.

In experimentally infected pigs the trypanosomes appeared in the peripheral blood in two to five days after intraperitoneal inoculation, and in from seven to eleven days after subcutaneous inoculation. The fever is intermittent and the appearance of trypanosomes in the blood coincides with the elevations of temperature. At the time of death the organisms are very numerous in the blood.

Clinically the disease is characterised simply by progressive emaciation, without any oedema, paralysis or lesions of the eyes.

At the post-mortem the spleen may be found to be three times the normal size.

(31) MOHLER (J. R.), EICHHORN (A.), & BUCK (J. M.). **The Diagnosis of Dourine by Complement-Fixation.**—*American Jl. Vet. Med.* 1913. Nov. Vol. 8. No. 11. pp. 581–587.

After trying a number of methods of obtaining antigen the authors adopted the plan of using an emulsion of the spleen of rats made with salt solution. The trypanosome used as antigen was not *T. equiperdum*, but *T. evansi*. " As dourine is the only known trypanosome infection of horses existing in this country, the value of even a group reaction was immediately appreciated and attention was directed to the carrying out of this idea in our diagnostic work."

Excellent results are claimed for the method.

(32) BRUCE (David), HARVEY (D.), HAMERTON (A. E.), & Lady BRUCE. **Morphology of Various Strains of the Trypanosome causing Disease in Man in Nyasaland.—The Mzimba Strain.**—*Proc. Roy. Soc.* 1913. Oct. 1. Series B. Vol. 87. No. B. 592. pp. 26–35. With 3 plates.

This paper deals with the question whether the trypanosome causing human disease in Nyasaland is restricted to the game and " fly " of the Proclaimed area or whether it extends north and south along the fly-belt. The trypanosome dealt with was found in the blood of a donkey at Mzimba about 100 miles north of the northern border of the Proclaimed area. Tables of measurements of the trypanosome in a number of different animals, and three plates illustrating the fixed and stained organism are given. The conclusions arrived at are as follows:—

" 1. The trypanosome of the Mzimba strain is the same species as that occurring in the wild game inhabiting the Proclaimed area, Nyasaland.

"2. It has already been concluded that this species is *T. brucei* vel *rhodesiense*.

"3. Hence it would appear that wild *G. morsitans* occurring in a district 100 miles north of the Proclaimed area are infected with the trypanosome which causes the human trypanosome disease of Nyasaland."

(33) Eckard (B.). **Uebertragung des *Trypanosoma rhodesiense* durch die *Glossina palpalis*.** [The Transmission of *T. rhodesiense* by *G. palpalis*.]—*Centralbl. f. Bakt.* 1. Abt., Orig. 1913. Nov. 26. Vol. 72. No. 1/2. pp. 73–76.

In this paper the author gives a chronological list of the more important work that has been done in connection with the transmission of trypanosomes by tsetse flies and draws the conclusion that given favourable conditions any known pathogenic trypanosome can develop in any species of Glossina. Further observations are necessary to decide whether any particular species of Glossina is especially concerned in the transmission of trypanosomiasis.

The author has had the opportunity of carrying out some experiments in the transmission of *T. rhodesiense* derived from a case of sleeping sickness in Nyasaland with *G. palpalis*.

Four hundred and seventy-six laboratory-bred *G. palpalis* were fed in series on infected guinea-pigs and after a period of starvation of two days were fed upon healthy goats and monkeys. Some of these animals were found to be infected on the 32nd day.

It was found that 2·5 per cent. of the total number of flies were infective, and developmental forms were found in nine flies which had died by the 10th day.

Three of the infective flies were used for the purpose of determining the infectivity of the trypanosomes in the various organs. After they had been fed upon healthy animals for two days they were killed by chloroform and their salivary glands, proventriculus and intestines were used for the subcutaneous inoculation of healthy monkeys. All the animals were found to be infected on the 5th day.

These results are in agreement with those obtained by Kinghorn and Yorke, but in striking contrast with those obtained by Kleine, Eckard, and Miss Robertson.

The possibility is considered that injury to the salivary glands might have been responsible for the contamination of the other organs, but the author is of the opinion that the number of experiments negatives this possibility.

It is further suggested that the ages of the flies might be a determining factor.

In the author's experiments the flies were 40 days old and in those of Kleine and Eckard they were from 50 to 60 days old. With the object of obtaining some evidence on this point a fly was kept until the 54th day when it was dissected, its organs being used for the inoculation of monkeys. In this case only the one inoculated from the salivary glands became infected. Examination of the fly shewed that numerous trypanosomes were present in the intestine, and the author concludes from this that development in the intestine gradually declines, the virulent parasites making their way to the salivary glands.

(34) KLEINE (F. K.) & ECKARD (B.). **Ueber die Bedeutung der Haustiere und des Wildes für die Verbreitung der Schlafkrankheit.** [The Importance of Domesticated and Wild Animals in the spread of Sleeping Sickness.]—*Zeitschr. f. Hyg. u. Infektionskrankh.* 1913. July 17. Vol. 75. No. 1. pp. 118–122.

Experiments were carried out in which infective *G. palpalis* were fed upon healthy sheep, goats and monkeys. Of 13 instances in which sheep and goats were used the result was negative in nine, while in the monkeys (number not stated) the result was invariably positive.

The authors were unable to infect *G. palpalis* on three out of seven animals in whose blood *T. gambiense* was to be found.

Two goats which had been infected in September 1910 recovered, as shewn by experimental inoculation and fly experiments. The animals failed to become infected again when re-inoculated subsequently.

Five oxen, 55 goats and 25 sheep from districts in which sleeping sickness was widely spread were examined and *T. gambiense* was found in one ox, one goat and one sheep.

The authors failed to find *T. gambiense* in any of the game examined.

(35) TAUTE (M.). **Untersuchungen über die Bedeutung des Grosswildes und der Haustiere für die Verbreitung der Schlafkrankheit.** [The Significance of Big Game and Domesticated Animals in the Spread of Sleeping Sickness.]—*Arbeit. a. d. Kaiserl. Gesundheitsamt.* 1913. Aug. Vol. 45. No. 1. pp. 102–112. With 1 plate.

These experiments were carried out at Lubimbinu in Portuguese Nyasaland. This place is itself fly-free, but is surrounded by a fly belt in which *G. morsitans* is plentiful. The population is free from trypanosomiasis, but the contrary is the case with domestic animals. Cattle and sheep are not found, goats and dogs only occasionally.

Thirty-seven wild animals were examined and trypanosomes were found in 20, either by direct examination or by experimental inoculations. Trypanosomes possessing the pathogenic range of *T. rhodesiense* were found in six of the inoculated monkeys and dogs. The remaining trypanosomes found belonged either to the *T. vivax* or *T. pecorum* groups.

Polymorphic trypanosomes shewing posterior nuclear forms were found in six out of ten animals upon which wild *G. morsitans* were fed. Seven dogs and a goat from the fly-belt were found to be infected with a trypanosome which was morphologically similar.

Experimentally infected dogs and goats died on an average in 36 and 16 days respectively, and shewed keratitis and oedema of the face.

The author states that if the trypanosome be in reality *T. rhodesiense*, about 16 per cent. of the game and domesticated animals are infected while the population remains free from infection.

To test this question of identity the author fed a number of laboratory-bred flies upon a monkey infected with the antelope strain. After a period of starvation for a day they were fed upon a series of goats, monkeys and dogs up to the 27th day. From the 28th to the 32nd day they were fed upon the author and from the 33rd to the 44th day upon another series of animals. The four animals upon which

the flies were fed from the 20th to the 27th day became infected, as did the three animals fed upon from the 33rd to the 44th day, but the author remained in good health.

A second experiment of a similar nature was carried out and with the same result.

In a third experiment the author was inoculated with 2 cc. of blood from a naturally infected dog but failed to become infected, while animals inoculated with the same blood all became infected and died.

Blood drawn from the author failed to infect a monkey and a number of dogs.

The author considers that the trypanosome of game and domesticated animals is *T. brucei*.

(36) MELLO (U.). **Le *Trypanosoma gambiense* a-t-il une Affinité pour le Testicule?**—*Bull. Soc. Path. Exot.* 1913. Oct. Vol. 6. No. 8. pp. 583–588.

The experiments detailed in this paper were carried out to control the statement made by UHLENHUTH and EMMERICH to the effect that in rabbits inoculated with *T. equiperdum* and *T. gambiense* the multiplication of the trypanosomes is far more advanced in the testicles than in the blood. This multiplication takes place, according to these authors, in both testicles even when only one has been the seat of inoculation, and it occurs even when the animal has been inoculated by some other path.

Seven rats, five guinea-pigs, four rabbits, and a monkey were used, and the trypanosome employed was *T. gambiense*.

Rats. In rats the trypanosome first made its appearance in the blood, no matter in what manner the animal was inoculated. Parasites could be found in small numbers only in the testicle, even when that had been the seat of inoculation, and they were always more numerously present in the blood.

Guinea-pigs. Trypanosomes made a rapid appearance in the testicles in those cases only in which that had been the seat of inoculation. After intra-testicular inoculation the parasites may be discoverable in the other testicle before they can be found in the blood.

Monkey. The appearance of trypanosomes in the testicle did not precede their appearance in the blood.

Rabbits. The experiments carried out with these animals at first offer the most support to the view expressed by UHLENHUTH and EMMERICH, since on several occasions trypanosomes were fairly numerous in the testicles while still scanty in the blood (as is the rule in rabbit trypanosomiases). The author does not think that this is conclusive. He was informed by LAVERAN that he had frequently observed that trypanosomes multiply more rapidly in oedematous liquid when that is present in any part of the body than in the blood, and it was in the oedema resulting from the inoculation or from repeated punctures that the trypanosomes were found. Further, when a pipette is introduced into the testicle the liquid obtained is frequently from the sheath of the testicle and not from the substance of the organ itself. It is easy to conceive that trypanosomes might be more numerous in this than in the blood after intraperitoneal inoculation.

(37) Macfie (J. W. Scott). **On the Morphology of the Trypanosome (*T. nigeriense*, n. sp.) from a Case of Sleeping Sickness from Eket, Southern Nigeria.**—*Ann. Trop. Med. & Parasit.* 1913. Aug. Vol. 7. No. 3A. pp. 339–356. With 1 plate.

In the unstained state it can be observed that some of the parasites are long and slender and others short and stout. The former execute rapid vibratory and translatory movements. The translatory movement is spasmodic.

In preparations fixed with alcohol or osmic acid and stained with Giemsa the longest trypanosome found measured 32 microns and the shortest 8 microns. The breadth varies from 1 to 2·5 microns, and the short individuals are generally the stoutest. The trypanosome is polymorphic. Two long slender forms have been observed, one in which the micronucleus is terminal and the other in which it is situated about 1 micron from the posterior extremity, the extremity of the body being drawn out into a blunt " snout." In some parasites the nucleus shews a clear area in the centre.

The trypanosome appears to be feebly pathogenic for laboratory animals. The original guinea-pig in which the author received the strain had at the time of writing been alive 124 days since inoculation and was still apparently well. Other animal inoculations made so far are as follows:—Five guinea-pigs have not shewn trypanosomes and one of these has been inoculated 56 days. Three mice out of seven have shewn very small numbers of trypanosomes in from four to eight days after inoculation. Two goats and two dogs have never shewn trypanosomes, and in one monkey they appeared in small numbers on the 10th day, but have up to the time of writing (22 days after inoculation) always been scanty.

(38) Macfie (J. W. Scott). **Preliminary Note on the Development of a Human Trypanosome in the Gut of *Stomoxys nigra*.**—*Ann. Trop. Med. & Parasit.* 1913. Nov. Vol. 7. No. 3B. pp. 359–361. With 1 text-fig.

In this short note the author records the results obtained in a small number of experiments which circumstances compelled him to interrupt.

A number of *Stomoxys nigra* were fed upon a guinea-pig infected with a trypanosome from a case of sleeping sickness from Eket in Southern Nigeria. Thirteen flies were dissected from one to six days after being fed. In six of them flagellates were found in the mid-gut. Twelve flies caught in the laboratory which had not been fed upon the guinea-pig were dissected, but in none were any flagellates found.

Further experiments were made with flies bred in the laboratory. Two bred flies were fed upon the infected guinea-pig the day after hatching, and three days later herpetomonas were found in the mid-gut of each. There were none in the salivary glands or the proboscis. As controls two bred flies which had not been fed upon the guinea-pig were dissected and no flagellates were found.

(39) LAVERAN (A.). **Au Sujet des Infections des Souris par le *Trypanosoma duttoni*.** [The Infection of Mice with *T. duttoni*.]—*Bull. Soc. Path. Exot.* 1913. Nov. Vol. 6. No. 9. pp. 626–627.

The author received six mice inoculated with the trypanosome from Senegal. The species of mouse was *Mus maurus*. They were all shewing trypanosomes in their blood at the time of arrival. Four of these mice were killed for the inoculation of white mice, and the infection was followed by periodical examinations in the other two.

The author was unaware how long the mice had been infected before they came into his possession, but after their arrival they lived for 22 and 26 months and apparently died of old age. Trypanosomes could always be found in their blood in larger or smaller numbers.

Two of the white mice inoculated appeared to make complete recoveries, trypanosomes disappearing from their blood after seven and four and a half months respectively.

It was shewn by inoculation that the progeny of infected mice possessed no immunity.

(40) LAVERAN (A.). **Trypanotoxines. Essais d'Immunisation contre les Trypanosomes.**—*Bull. Soc. Path. Exot.* 1913. Dec. Vol. 6. No. 10. pp. 693–698.

The author has repeated with slight modifications the experiments of SCHILLING and RONDONI regarding the production of trypanotoxines in liquids containing dead trypanosomes, when these are heated for certain periods at 37° C., and the immunising effects of sub-toxic doses of such materials. He has failed to produce either the toxic or the immunising effect, and concludes with regard to the latter that when the results are not entirely negative they are partial and inconstant.

(41) LEVADITI (C.) & MUTERMILCH (St.). **Recherches sur la Production des Anticorps chez les Animaux Trypanosomiés et traités par le Salvarsan.**—*Bull. Soc. Path. Exot.* 1913. Dec. Vol. 6. No. 10. pp. 699–704.

The authors' experiments in connection with this subject, which have not been previously published, were carried out in 1911, and the reason for their publication lies in the publication of the results obtained by MARGULIES, and ELLIS and SWIFT.

They find that if "606" be administered intraperitoneally to rats infected with nagana, on the third day of infection, when the trypanosomes are numerous in the blood, the serum becomes trypanocidal two hours later. The longer the period elapsing between the disappearance of the trypanosomes from the blood and the taking of the sample of serum the less is its trypanocidal power. This power disappears completely by the 30th hour. The fact that heating the serum to 56° C. does not destroy its trypanocidal power indicates that it is not due to trypanolytic properties of the serum, but to the presence of "606" in it.

On the other hand evidence is furnished by the experiments that, in spite of the richness of the blood in trypanosomes and the considerable quantity of antigen liberated by the action of the drug, antibodies do not make their appearance until the 5th day after inoculation.

(42) Schilling (C.) & Rondoni (P.). **Tossine Tripanosomiche e Immunità di fronte ai Tripanosomi.** [Trypano-toxins and Immunity against Trypanosomes.]—*Lo Sperimentale.* 1913. Nov. 13. Vol. 67. No. 5. pp. 595–613.

In this paper the authors record the toxic effects of inoculating mice with suspensions of trypanosomes kept at 37° C. for variable periods.

They also found that emulsions of trypanosomes heated to 37° C. for certain periods were capable of conferring a degree of immunity.

(43) Johnston (J. E. L.) & Macfie (J. W. Scott). **Observations on the Action on Trypanosomes of certain Drugs and of *Staphylococcus pyogenes*.**—*Jl. London School Trop. Med.* 1913. Nov. Vol. 2. No. 3. pp. 207–212.

This paper contains the records of a few investigations carried out with bromine, iodine, and osmic acid and also *Staphylococcus pyogenes*. The experiments were made *in vitro* and *in vivo*, but the results were almost entirely negative in character.

A few initial experiments were made to determine the effects of dilute solutions of iodine, bromine, and osmic acid upon trypanosomes in cover-slip preparations. The results obtained were very inconclusive.

In the experiments carried out on living animals, sheep infected with *T. vivax* and rats infected with *T. lewisi* were used. In the case of the sheep the injections were given intravenously, and in the rats subcutaneously. The solutions used were:—Tincture of iodine in distilled water in the proportion of 7 minims to the drachm, 2·5 per cent. bromine in the same proportion, and 2 per cent. osmic acid, 12 minims to the drachm. The rats received doses varying from 5 to 20 minims, and the sheep, of which only one appears to have been subjected to experiment, was given one drachm of pure tincture of iodine intravenously. The drugs appeared to have a disturbing effect not only on the trypanosomes but also on the hosts. The authors consider that trypanophagocytosis occurs and that large numbers of trypanosomes may be rapidly destroyed by this means.

The injection of staphylococcus vaccines into rats infected with *T. lewisi* appeared to be without effect.

(44) Macfie (J. W. Scott) & Johnston (J. E. L.). **Auto-Erythrophagocytosis as an Aid to the Diagnosis of Trypanosomiasis. (Preliminary Communication.)**—*Jl. London School Trop. Med.* 1913. Nov. Vol. 2. No. 3. pp. 212–215.

The authors have observed the ingestion of red cells by leucocytes to which attention was drawn by Connal and others. They have made observations using *T. lewisi*, a trypanosome resembling *T. gambiense* from a case of sleeping sickness, and *T. duttoni*. They divide their cases into the following three groups:—

1. Those in which leucocytes containing red cells were present in blood which subsequently contained trypanosomes.

2. Those in which leucocytes containing red cells and trypanosomes were present at the same time.

3. Those in which leucocytes containing red cells were found after the disappearance of trypanosomes.

The ratio of cells containing red corpuscles to other leucocytes is seldom higher than 1 per cent.

The suggestion is put forward that erythrophagocytosis may be a material aid in the diagnosis of trypanosomiasis.

(45) KOLLE (W.), HARTOCH (O.), ROTHERMUNDT (M.), & SCHÜRMANN (W.). **Chemotherapeutische Experimentalstudien bei Trypanosomeninfektionen.** [Experimental Chemotherapeutic Investigations in connection with Trypanosome Infections.]—*Zeitschr. f. Immunitäts. u. experim. Therapie.* 1913. Aug. 5. Vol. 19. No. 1. pp. 66–97.

This paper contains a repetition of results previously published (see References 194 and 556, Vol. 1, this *Bulletin*) together with a description of some further experiments with antimony trioxide.

Attention is drawn to the necessity of a thorough study of the actions of various compounds of antimony, as in the past it has been compared too closely with arsenic .

Experiments were carried out using metallic antimony reduced to a fine powder and suspended in oil. This material was injected intramuscularly into mice infected with nagana.

The strain of trypanosomes used was invariably fatal in five days, and the drug was administered on the 2nd or 3rd day.

It was found that the toxic dose was 5 mg. per 10 g. body weight, and that 1 mg. caused a disappearance of trypanosomes with the utmost certainty, and no relapses occurred. Larger doses invariably produced poisoning.

Numerous organic and inorganic compounds of antimony were tested with the object of finding out the connection between their composition and their therapeutic effects. Pentavalent compounds were found to be by far less toxic than the trivalent but they were practically without therapeutic effect in trypanosome infections. The trivalent compounds were both toxic and trypanocidal, particularly the trioxide, to which the authors give the name " Trixidin."

Experiments showed that a dose of 120 mg. per 10 g. body weight produced neither acute nor chronic toxic effects, nor did it produce any changes in the blood or organs.

It was observed that the intramuscular injections of large doses of " Trixidin " into rabbits, dogs, and apes was liable to lead to abscess formation. Experiments are being carried out with the object of avoiding this by distributing the injections over different parts of the body.

" Trixidin " is insoluble in water and is slowly absorbed.

While mice withstand the injection of 100 mg. per 10 g. body weight, one hundredth part of this quantity is effective in the treatment of experimental nagana in them.

The injection of sufficiently large doses of " Trixidin " protected mice in the majority of cases when inoculated as much as 16 days after with nagana and up to the time of writing this immunity had lasted 91 days.

A list is included in the paper shewing a number of compounds of various metals which were tried and which were found to be either useless, or, though useful, impracticable in application.

The authors have been able to effect cures with drugs, which when injected either lead to intoxication or permit of relapses, by applying them externally in the form of salves.

"Trixidin" was found to be ineffectual in the treatment of mice infected with the spirochaete of African relapsing fever and *Schizotrypanum cruzi*.

(46) MONFORT (F.). **Essais de Traitement des Trypanosomiases expérimentales par l'Arsénophénylglycine.**—*Bull. Soc. Path. Exot.* 1913. Oct. Vol. 6. No. 8. pp. 588-590.

The author's experiments have been carried out with adult mice inoculated with *T. gambiense*, *T. rhodesiense*, *T. dimorphon*, and *T. congolense*.

In the majority of cases the dose employed was 3 mg., but mice tolerate twice or three times this dose without shewing any symptoms. The drug was administered by intramuscular injection. Brief details are given of four series of experiments made with the trypanosomes mentioned and the results arrived at may be summarised as follows:—

In all, fourteen animals inoculated with the two human trypanosomes were treated and in no case was there a relapse, the animals being kept under observation up to 86 days in the case of the *gambiense*, and 64 days in the case of the *rhodesiense*.

Of five animals infected with *T. dimorphon* only one shewed a relapse during a period of 75 days.

Seven mice inoculated with *T. congolense* were put under treatment with doses of 3, 6, and 9 mg., but in no instance did the drug have any effect beyond a brief disappearance of the trypanosomes from the blood.

(47) HECKENROTH (F.) & BLANCHARD (M.). **Le Néosalvarsan dans le Traitement de la Trypanosomiase humaine.**—*Bull. Soc. Path. Exot.* 1913. Oct. Vol. 6. No. 8. pp. 591–512.

In this paper the authors publish the results obtained in the treatment of human trypanosomiasis with a single intravenous injection of neosalvarsan. In 16 cases the persons treated were in good condition and in the remainder in moderate or bad condition.

The drug was administered dissolved in distilled water in the proportions of 0·15 g. and 0·45 g. per 25 cc. The dose varied from 1 cg. per kilog. to 2·1 cg. per kilog. It was observed in some cases in which the dose was 1·5 cg. or over that fever, vomiting, and diarrhoea occurred some hours after.

The drug appears to cause a rapid disappearance of the trypanosomes from the blood, but acts with less certainty upon those in the lymphatic glands. Trypanosomes have been discovered by gland puncture from 1 to 7 days after the administration of 1·7 cg. per kilog. of the drug.

Of the 25 cases treated 4 have not yet been re-examined, 9 have remained without relapse after an average period of 4½ months, 2 died after 3 months and 1½ months without relapse, and in 10 cases there has been a relapse after an average period of 2½ months.

(48) NÄGLER (K.). **Experimentelle Studien über die Passage von *Schizotrypanum cruzi* Chagas durch einheimische Tiere. Teil I.** [The Passage of *Schizotrypanum cruzi* through Indigenous Animals.]—*Centralb. f. Bakt.* 1. Abt., Orig. 1913. Oct. 4. Vol 71. No. 2/3. pp. 202–206. With 1 plate.

The author's conclusions are as follows :—

1. Mice, rats, guinea-pigs, rabbits, dogs, and cats are susceptible to infection with *Schizotrypanum cruzi*. It has not been found possible to transmit the parasite to canaries, lizards, and frogs.
2. The parasite is not transmitted hereditarily.
3. Infection experiments with insects failed.
4. The "male" and "female" forms described by CHAGAS as sexual individuals are vegetative forms.
5. No morphological differences are to be observed in the parasite obtained from mice, rats, and guinea-pigs.
6. In the peripheral blood, and even two hours after death, numerous divisions occur.

SPIROCHAETOSIS.

(49) MARCHOUX (E.) & COUVY (L.). **Argas et Spirochètes. Deuxième Partie. Le Virus chez l'Acarien.** [Argas and Spirochaetes. Second Part. The Virus in the Tick.]—*Ann. Inst. Pasteur.* 1913. August. Vol. 27. No. 8. pp. 620-643.

The authors recapitulate the facts which they claim to have established in the first portion of this paper (see this *Bulletin*, Vol. 1. No. 5. pp. 298–301), viz., (1) the granules found in the tick stand in no relationship to the spirochaete and therefore the method of preservation of infection and hereditary transmission must be sought elsewhere; (2) spirochaetes retain their virulence in the coelomic cavity of the tick as such, with the single modification of a decrease in thickness.

In the second portion of the paper the authors propose to shew that spirochaetes alone are responsible for the transmission of the infection.

Experiments are quoted shewing that the inoculation of material obtained by grinding up infected ticks sometimes produces infection but more usually confers immunity. It is further shewn that inoculation with a portion of an infected tick such as a salivary gland or an oviduct is also followed by immunity.

That this immunity is not due to antibodies formed in the tick was shewn by the fact that if the material was heated to 55° C. for five minutes the power to infect was destroyed, while the power to confer immunity remained. On the other hand if the heating was continued for 20 minutes immunity did not result. These results agree with those obtained when material known to contain spirochaetes is treated in exactly the same way. It was also shewn that the filtration of such material destroyed its power both of infecting and immunising.

Using WRIGHT'S method of estimating the number of spirochaetes present in a quantity of liquid, the authors have carried out a number of experiments having for their object the estimation of the number of spirochaetes required to confer immunity, and to produce infection. The bird selected for the experiments was the padda and the following results were arrived at. By intramuscular inoculation it was necessary

to inject 20,000 spirochaetes in order to set up infection. Immunity was conferred when the number of spirochaetes injected lay between 17,000 and 735. If a smaller dose was administered no effect of any kind was produced. When intravenous inoculation was resorted to it was found that 17,000 spirochaetes caused infection, 70 conferred immunity, and 17 produced no effect. Thirty spirochaetes introduced into a fowl's egg during incubation sufficed to set up infection. The figures given do not pretend to be absolutely exact, but the authors claim that, since they have been working with a single strain and their results have always been concordant, the figures obtained are sufficiently exact.

Marchoux and Couvy have been unable to find any coxal gland in argas and they believe that the so-called coxal fluid is in reality coelomic fluid which escapes by a process of rapid filtration. This, they believe, plays no part in the transmission of infection to the vertebrate host.

Although numerous dissections have been made, spirochaetes have been found in exceptional cases only in the salivary glands and then only in small numbers in individuals which have been starved for a fortnight. Examination of the excretory ducts of the salivary glands shewed that they contained considerable numbers of spirochaetes including numerous dividing forms. This was found to be the case even in ticks that had been starved for as long as two months. Further examinations shewed that after a meal the parasites had almost entirely disappeared from the excretory canal and that after an interval of from two to five days they were very numerous in the salivary glands, whence they passed to the excretory ducts.

It is said that a meal of non-infected blood causes a fresh multiplication of the parasite in the tick and fresh invasion of the excretory ducts. An infected tick which had become non-infective through starvation is said to have again become infective as a result of a meal of non-infected blood.

Two explanations of the transmission of the infection through the egg of the tick, which the authors claim to have proved, are given. The secretion of the cephalic glands which serves to cement the eggs together contains spirochaetes and these are capable of penetrating the chitinous covering of the egg. The genital organs contain spirochaetes, as do the salivary glands, and these penetrate the ova. By means of a fine pipette the contents of washed eggs have been withdrawn and long slender spirochaetes have been detected with the ultramicroscope. The contents of 20 eggs injected into a padda failed to infect, but conferred immunity. A fowl's egg which had been incubated for four days was inoculated with the contents of two eggs. On the ninth day after inoculation an emulsion was made of the tissues of the embryo and though spirochaetes could not be detected by direct examination the injection of this material into a padda conferred immunity. The conclusions arrived at are as follows :—

1. The injection of a constant quantity of material obtained by grinding up infected ticks sometimes causes infection and sometimes confers immunity.
2. The infectivity depends upon the number of spirochaetes contained in the ticks.
3. The infective, immunising, and non-infective doses can be measured.
4. All the organs are invaded by the parasite.

5. The spirochaetes pass from the coelom to the acini of the salivary glands and collect in the excretory canal.
6. The salivary secretion is the vehicle of infection.
7. The spirochaetes are present in large numbers in the cephalic glands and are able to penetrate the chitinous membrane of the eggs.
8. The eggs of *Argas persicus* contain spirochaetes, and a single one may contain more than 30.

(50) LAUNOY (L.) & LÉVY-BRUHL (M.). **L'Infection Spirillaire chez les Poules éthyroïdées. Pouvoir Vaccinant de leur Serum.** [On Spirillar Infection in Fowls deprived of the Thyroid Glands, and the Immunising Power of their Serum.]—*Compt. Rend. Soc. Biol.* 1913. Nov. 14. Vol. 75. No. 31. pp. 352-354.

The authors' conclusions are that in adult fowls, which have been infected with *S. gallinarum*, the thyroid glands appear to play no part in the resistance offered to infection nor in the rapidity with which and the extent to which antibodies are formed.

(51) LAUNOY (L.). **Le Fer du Sang chez la Poule normale et dans l'Infection par le *Spirochaeta gallinarum* Marchoux et Salimbeni.** [The Iron-Content of the Blood in Normal Fowls and in Fowls infected with *S. gallinarum*.]—*Compt. Rend. Soc. Biol.* 1913. Oct. 24. Vol. 75. No. 29. pp. 248-249.

The iron-content of the blood of the fowl is on an average 0·045 per 100 cubic centimetres.

Bleeding does not exert any influence on the blood content.

In blood taken five days after infection with *S. gallinarum* the iron-content is 25 per cent. lower than the average.

(52) LAUNOY (L.) & LÉVY-BRUHL (M.). **Sur l'Anémie observée chez la Poule au Cours de l'Infection par le *Spirochaeta gallinarum*.** [On Anaemia in Fowls in the course of Infection with *S. gallinarum*.]—*Compt. Rend. Soc. Biol.* 1913. Oct. 24. Vol. 75. No. 29. pp. 250-252.

The authors' observations have been made upon the blood of fowls inoculated with an attenuated strain of the spirochaetes; parasites appearing in the blood on the second day, and disappearing on the 5th or 6th.

In normal blood the number of red corpuscles varies from 2,180,000 to 3,160,000. During the course of infection a diminution was observed from the time parasites appeared in the blood and the number steadily fell, until about the 5th day it was reduced by half.

By the 12th or 13th day the number had increased again to the normal.

During the course of the infection very small and very large corpuscles were encountered. In addition to these there were many corpuscles which stained faintly or not at all with eosin. The latter was observed from the 3rd to the 10th day.

(53) HATA (S.). **A Contribution to our Knowledge of the Cultivation of *Spirochaeta recurrens* [*recurrentis*].** (Paper read before the Section of Tropical Med. XVII International Medical Congress, London, 1913.)—*Centralbl. f. Bakt.* I. Abt., Orig. 1913. Nov. 26. Vol. 72. No. 1/2. pp. 107–112. With 1 text-fig.

The author has found that NOGUCHI's medium for the cultivation of this spirochaete can be modified in such a way as to obviate the necessity of having ascitic fluid and rabbit kidney. He also finds that it is unnecessary to place sterile paraffin upon the top of the medium.

The ascitic fluid can be replaced by horse serum. The serum is mixed with twice its volume of sterile physiological salt solution and the tubes are placed in a water bath at 58° C., the temperature being very slowly raised until in about three hours it stands at 70° C. The tubes are kept at this temperature for 30 minutes. They are then set aside to cool. The medium forms an opaque semi-coagulated mass.

Instead of rabbit kidney the author uses fragments of the "buffy coat" from the coagulum of the horse serum. This is cut into pieces about 1 centimetre in diameter and two or three pieces are pushed down to the bottom of the coagulated medium.

When this medium is inoculated with blood containing the spirochaete and the tubes incubated to 37° C., multiplication occurs by the second day and actively motile spirochaetes can be found in the medium up to the 10th to the 14th day. The virulence of the organism is maintained in this medium better than in NOGUCHI's. Mice inoculated with a 21 days culture have become infected.

The author has a strain which has been passed through 27 passages in 150 days.

Spirochaetes cultivated at 37° C. will remain alive for about three weeks, but cultures which are kept at room temperature from the 4th or 5th day will retain their vitality for as long as 60 days and possibly longer.

LEISHMANIASIS.

(54) JANNOT (A.). **Infection de la Souris avec le Virus de la Leishmaniose Canine Naturelle.** [Infection of Mice with Leishmania from Naturally Infected Dogs.]—*Bull. Soc. Path. Exot.* 1913. Dec. Vol. 6. No. 10. pp. 683-685.

The author has succeeded in inoculating two mice with material taken from the bone marrow of two dogs which were found to be naturally infected in Tunis. From these a number of mice, rats, and gerbils—14 in all—were inoculated, but only two mice became infected. Further passage experiments were not carried out.

(55) LEMAIRE (G.), SERGENT (E.), LHÉRITIER (A.). **Recherches sur la Leishmaniose du Chien d'Alger.** [Researches on Canine Leishmaniasis in Algiers.]—*Bull. Soc. Path. Exot.* 1913. Oct. Vol. 6. No. 8. pp. 579-581.

In August 1912 the authors took up the examination of the dogs killed in Algiers with the object of ascertaining the percentage infected with leishmania. They were unable to carry on their investigation

continuously throughout the year, but they obtained complete records for the two periods August to November 1912, and April to July 1913.

The results are given in two tables (which appear to contain some arithmetical inaccuracies) and from these it may be gathered that during August and November no infected dogs were found among 44 examined, while during September and October one infected animal was found in each month out of 73 and 88 examined. In this series of animals the examinations involved the preparation of smears from the spleen and bone marrow, four smears being made from each animal.

During the second period of four months, in addition to the preparation of films, cultures were made from the bone marrow.

During this period 272 dogs were examined and seven infected animals were discovered.

It would appear from this that, while the disease can be discovered at all periods of the year, the figures indicate that more cases occur during the months of April and May than during July and August.

It is said that the greater number of cases found during this period is partly due to the fact that a greater number of dogs were examined and to the fact that cultivation was resorted to. In two cases positive cultivations were made when the first examinations of the films had been negative.

A clinical fact noted by the authors is that while some of the infected dogs shew lesions involving the skin, the eyes and the mucous membranes, others shew not the slightest evidence of skin lesions, but only extreme emaciation.

(56) LAVERAN (A.). **Kala-azar méditerranéen et Kala-azar indien.**—*Bull. Soc. Path. Exot.* 1913. Oct. Vol. 6. No. 8. pp. 574-579.

This paper is a resumé of the report presented by LAVERAN and NICOLLE at the XVIIth International Congress of Medicine held in London in August 1913.

MALARIAL AND OTHER PROTOZOAL PARASITES OF THE BLOOD.

(57) BRUCE (David), HARVEY (D.), HAMERTON (A. E.), & Lady BRUCE. *Plasmodium cephalophi*, **sp. nov.**—*Proc. Roy. Soc.* 1913. Oct. 1. Series B. Vol. 87. No. B. 592. pp. 45-47. With 2 plates.

This parasite has been observed in the blood of two duikers in captivity. In one of them the attack was acute and the parasite was present in the blood for four days only. In the other the infection took a chronic course, organisms having persisted in the blood for a period of some months.

The gametes are circular, and the schizonts give rise to 8 to 12 merozoites. Invaded corpuscles shewed marked enlargement and paleness of colour. The pigment is collected into a single mass. There is intense concentration of the portion of the red cell within the food vacuole. The parasite is remarkable for its size, free merozoites sometimes measuring 3·5 by 4 microns, this being about the size of the normal red cell of the antelope. A full-grown schizont before cleavage of the protoplasm may measure 10 microns in diameter.

The duiker in which the infection ran a chronic course was captured

near the lake shore, and parasites were found in its blood a few weeks after its arrival at Kasu Hill. The animal was about three months old. It was probably infected before capture. The other animal was captured on the plateau and had been in captivity for six months before being brought to Kasu. It would appear that its infection was contracted locally.

The infection was discovered at the height of the dry season and though a systematic search was made no mosquitoes could be found.

Another young duiker, a reedbuck and a hartebeeste were in the same compound, but no parasites could be discovered in their blood.

(58) Leger (M.) & Bouilliez (M.). **Recherches Expérimentales sur *Plasmodium inui* Halberstaedter et Prowazek d'un *Macacus cynomolgus*.** [Experimental Investigations regarding *Plasmodium inui* of *Macacus cynomolgus*.]—*Ann. Inst. Pasteur.* 1913. Nov. Vol. 27. No. 11. pp. 955-985.

This paper is an amplification of those already published by the authors (see this *Bulletin* Vol. 1, Abstracts Nos. 172 and 531). The points dealt with are the following:—morphology, transmission by inoculation, the course of the experimental infection, attempts to transmit the infection to animals other than monkeys, the effects of quinine and splenectomy, attempts to cultivate the parasite, and the identification of the organism.

In the fresh state the parasites appear as round, ovoid, or amoeboid bodies within the corpuscles. Young parasites are difficult to recognise as they do not contain any pigment, and the gametes are distinguishable from the schizonts by the fact that the pigment contained in them is greater in amount and the individual granules are of larger size. The only free parasites seen are the gametes and young merozoites. The authors have never observed flagellation of the microgametocytes.

In stained preparations the following details can be observed. Young schizonts are round in shape and measure rather less than 2 microns in diameter. They are devoid of pigment and their vacuole-like nucleus contains a caryosome. This caryosome is sometimes rounded in shape and centrally placed, but it may be peripherally placed, producing a signet ring appearance. Occasionally two caryosomes are present, and these may be placed at opposite poles of the parasite, or side by side and connected by a delicate filament. A single corpuscle may be occupied by two or three parasites.

In older parasites the caryosome may be curved or rod-like. As the schizont increases in size, it becomes rounded and its protoplasm contains an increasing number of small pigment granules.

The maximum number of merozoites produced by schizogony is 16, and the pigment becomes collected together into a small mass in the centre of the parasite.

Microgametes are rounded or polyhedral, and contain a number of pigment granules scattered through their body. The nucleus, which occupies about a quarter of the parasite, takes the form of a number of rods of chromatin embedded in a pink matrix. Macrogametes are usually larger than the male elements and are often somewhat square in shape. Their protoplasm stains a deep blue tint. The pigment granules are smaller than in the microgametocyte and the nucleus stains deeply.

Red corpuscles containing parasites are not enlarged nor deformed, and they stain as intensely as those containing no parasites. At an advanced stage of infection there is marked anisocytosis with a preponderance of megalocytes, and it is remarkable that these are practically never invaded by parasites, while the microcytes frequently are. Polychromasia is not uncommonly seen, but no punctate basophilia has been observed.

The schizogonic cycle occupies 48 hours.

The parasite does not correspond exactly with any of the three malarial organisms of man, but possesses to some degree the principal characters of all three.

Inoculating intramuscularly, subcutaneously, and intraperitoneally, the authors have passed the virus through seventeen passages, and have infected the following species :—*Macacus cynomolgus*, *M. sinicus*, *M. rhesus*, *M. nemestrinus*, *Cercopithecus callitrichus*, *C. patas*, *C. cephus*, and *Papio anubis*. Two chimpanzees, a *Cercocebus fuliginosus*, and a maki were found to be refractory.

The disease as observed in animals experimentally infected occurs in two forms—acute and chronic.

The acute form is the more frequently seen. Parasites make their appearance in the blood in from 4 to 9 days after inoculation, and death takes place in from 10 to 18 days, the period elapsing between the appearance of parasites in the blood and death never exceeding 10 days. Fifty per cent. of the red corpuscles may be invaded and a single corpuscle may contain three parasites.

At the post-mortem examination there is not always observed enlargement of the liver and spleen, but these organs are grey or even black in colour. Preparations from these organs and from the lungs in some cases shew that there is an abundant infiltration with pigment. This is sometimes free and sometimes included within large mononuclear leucocytes and epithelial cells.

The virulence of the organism was neither exalted nor attenuated by the passages.

In the chronic form of the disease the period of incubation is not sensibly longer than in the acute form, and it is characteristic of this form of the disease that there are periods during which the parasite disappears from the circulation. After their first appearance in the blood they steadily increase in numbers for a time and then disappear either suddenly or gradually. The crisis may last for a week or even a month. During the relapse which follows parasites may be as numerous or slightly less numerous than during the crisis. As a rule there are two relapses and exceptionally three.

During a period of five or six weeks the animal does not appear to suffer in health, but subsequently it becomes dull and ceases to feed. Contrary to what is observed in the acute cases there is sometimes diarrhoea, but the haematuria and haemoglobinuria observed in acute cases have not been seen in chronic ones. The infection causes little or no rise of temperature.

All the monkeys in which the disease took a chronic course, with the exception of one, died after a longer or shorter interval. At the time of death there were no parasites in the blood and none had been observed for a variable length of time previously. Although parasites could not be discovered, the blood of one monkey which survived

228 days proved infective by inoculation. One animal had survived for nine months at the time of writing. The authors have failed to infect animals other than monkeys. Quinine as a prophylactic was found to be of doubtful value, and as a curative to be useless.

Splenectomy was practised upon an animal six months after inoculation when it appeared to have been free from parasites for some time. Parasites again made their appearance in the blood after the operation and the animal died during the following month. The operation was performed upon a second monkey before inoculation and the animal died of the chronic form of the disease four months afterwards.

The authors never observed the morphological changes in the parasite described by BUONIOL as occurring in animals upon which splenectomy had been performed.

Following BASS's technique the authors have succeeded in obtaining a continuation of the development of the parasite in vitro at about 22° C., but subcultures failed in every case. Citrated infective blood kept upon ice proved to be infective five days later and in another instance well stained preparations could be made from blood preserved in a similar manner for a month, but an animal inoculated on the eighth day failed to become infected.

The authors believe that the parasite is *Plasmodium inui* Halberstädter and Prowazek, to which species they also assign *Pl. cynomolgi* Mayer.

(59) JOYEUX (C.). **Note sur quelques Protozoaires Sanguicoles et Intestinaux observés en Guinée française.** [Some Protozoal Parasites of the Blood and Intestines observed in French Guinea.] —*Bull. Soc. Path. Exot.* 1913. Nov. Vol. 6. No. 9. pp. 612-615.

No new parasites are described in this paper, the author's object being to add to knowledge regarding the distribution and frequence of organisms already known.

(60) VISENTINI (A.). **Gli Emoparassiti della Talpa in Italia.** [The Blood Parasites of the Mole in Italy.]—*Arch. f. Protistenkunde.* 1913. Dec. 11. Vol. 32. No. 2. pp. 257-266. With 1 plate.

In 30 per cent. of the moles examined the author has found *Trypanosoma talpae*, and *Elleipsosoma thomsoni* in 4·34 per cent. He has also observed *Grahamella talpae* Brumpt, regarding the parasitic nature of which there appears to be great uncertainty.

(61) MOLDOVAN (J.). **Beitrag zur Entwickelung des *Leucocytozoon ziemanni* (Laveran).** [The Development of *Leucocytozoon ziemanni*.]—*Centralb. f. Bakt.* 1. Abt. Orig. 1913. Sept. 27. Vol. 71. No. 1. pp. 66-69. With 1 plate.

Two screech owls, which had shewn the gametes of this parasite in their blood during life, were examined by the author after death, and in films prepared from the lungs, heart, brain, liver, kidneys and bone marrow young endocellular schizonts were found. In addition to these, young male and female gametes were found. The schizonts contained as many as 30 nuclei. The spleen was not examined.

The young schizonts shew a central nucleus of loose texture surrounded in most instances by particles of chromatin. The cytoplasm is alveolar in structure.

As the parasite increases in size changes are to be observed in the nucleus. This becomes divided into a larger loose-textured portion and a smaller portion of very close texture. The smaller portion takes part in the formation of the nuclei of the schizonts, while the larger portion gradually increases in size, becomes less distinctly marked off, and finally disappears.

The segregation of the cytoplasm around the nuclei and the separation of the merozoites has not as yet been observed.

In a small proportion of the parasites nuclear division does not occur.

TOXOPLASMOSIS.

(62) Pixell (H. L. M.). **Notes on** *Toxoplasma gondii*—*Proc. Roy. Soc.* 1913. Oct. Series B. Vol. 87. No. B. 592. pp. 67-77. With 1 plate.

The parasite proves fatal to mice inoculated intraperitoneally in from five to 15 days. There may be an abundant or scanty peritoneal exudate, and the number of parasites present in this is not in proportion to the amount of exudate. Often parasites are scantily present in cases in which the infection runs an acute course. The parasites in the exudate are either free or enclosed in cells—mononuclear leucocytes or macrophages. Examination of the mesentery shews that the endothelial cells and the connective tissue cells may contain large numbers of parasites. The abdominal and thoracic organs may contain a few.

Multiplication takes place by a process of simple division. Occasionally a number of parasites situated side by side divide in different planes producing an appearance suggestive of cyst formation. Attempts to cultivate the parasite on a number of different media failed.

The author was unable to infect pigeons from mice, and it is stated that Nicolle has observed the same fact.

(63) Carini (A) & Maciel (J.). **Toxoplasmose naturelle du Chien.** [Natural Toxoplasmosis of the dog.]—*Bull. Soc. Path. Exot.* 1913. Dec. Vol. 6. No. 10. pp. 681-683.

Two puppies which were born in the Institute (S. Paulo, Brazil) had been inoculated with the virus of a little-known disease of the dog termed "nambiuvu." The animals died within a fortnight of each other (after an interval which is not stated) and, while the parasite of "nambiuvu" could not be detected, Toxoplasma was found.

Post-mortem examinations were made immediately after death and the following lesions were found:—a small amount of serous exudate in the thoracic and abdominal cavities, some areas of pneumonia in the lungs, and marked hyperaemia of the liver and kidneys. Toxoplasma was especially numerous in the lungs, but it was also found in the liver, kidneys, bone marrow, and spleen.

An emulsion of the organs of each of these dogs was used for the successful inoculation of other dogs and pigeons.

Young dogs are particularly susceptible, and death takes place in from 8 to 12 days, the lesions found at the post-mortem being identical with those encountered in natural cases. Adult dogs as a rule fail to become infected even when massive doses of virus are used.

The pigeons died in from 12 to 19 days. The parasite has been passed through a series of pigeons, and in some instances a symptom which has already been recorded by one of the authors, namely oedema of the eyelids and cloaca, has been observed. The parasite is very numerously present in the oedematous tissue.

In view of the facts that the morphology of the parasite occurring in natural and experimental cases in the dog and pigeon is identical with that found in the rabbit and pigeon, and the pathogenic ranges of *Tox. canis* and *Tox. cuniculi* are the same, it appears to be very doubtful whether the two should be considered to be different species.

HELMINTHS.

(64) Leiper (R. T.). **Seven Helminthological Notes.**—*Jl. London School Trop. Med.* 1913. Nov. Vol. 2. Part. 3. pp. 175-178. With 1 text-fig. [(*d.*) Flukes in the Dog in Asia. pp. 176-177.]

The trematodes recorded hitherto from the dog in Asia are: *Schistosoma japonicum, Paragonimus westermanii, Clonorchis endemicus,* and *Opisthorchis noverca.* As a result of the examination of material sent from Formosa three further parasites have to be added to the list. These are :—*Heterophyes heterophyes, Yokogawa yokogawa,* and a new species *Centrocestus cuspidatus,* var. *caninus.*

With the exception of the last these flukes are parasitic in man. *Heterophyes* has been found in two instances, in a Chinaman and in a Japanese at the Albert Dock Hospital. *Yokogawa* is said to be sporadic in man and the dog in Korea, Japan, and Formosa. A single specimen of *Centrocestus* was present in a slide of faeces from the dog and, although the parasite closely agrees with that described by Looss as occurring in the kite in Egypt, Leiper follows Looss's ruling and classifies the parasite of the dog as a distinct variety naming it *Centrocestus cuspidatus,* var. *caninus.*

The specimen from the dog differs from that described by Looss in that there are only 28 spines round the mouth instead of 36, but some of the spines may have been lost.

(65) Pricolo (A.). **Sur la Filaire hématique du Chameau.** [On the Blood Filaria of the Camel.]—*Centralbl. f. Bakt.* 1. Abt., Orig. 1913. Oct. 4. Vol. 71. No. 2/3. pp. 199-200.

In this paper the author describes the adult forms of the larval filariae found by him in the blood of camels in Tripoli and described in the *Centralblatt für Bakteriologie* 1913, January 11.

He states that he has placed beyond all doubt the relationship between the larvae and the adults.

Filariasis of the camel generally occurs during the hot weather, and the larvae are almost exclusively found in the blood during the night.

Male and female parasites have been found in the blood vessels of

the lung upon two occasions, and in those of the testicles on six. They appear to be capable of escaping easily from the lumen and, except during the first stage of their existence, they do not appear to become attached to the vessel walls.

The lungs in which the author found the parasites shewed calcareous nodules, but the association between these and the worms is doubtful.

In infested testicles there is a condition of hypertrophic sclerosis. The testicles are increased in size and are firmer than normal, the surface presenting a bosselated appearance. Microscopic examination shews that the testicular substance is for the most part replaced by connective tissue.

The female has the appearance of a thick strand of catgut with a slight tinge of pink colouration. The length of the worm is about 22 centimetres and the thickness 666 microns. The head is large, measuring about 140 microns, and it is suddenly constricted posteriorly to form the neck, which is about 117 microns in length and rather more slender than the head. The body of the worm attains its maximum thickness at about the point where the ovaries first become visible. The tail terminates in a truncated point.

The ovaries contain thousands of cells in different stages of development. They are polygonal in outline, measuring about 30 microns in length and varying from 11 to 20 in width.

The eggs contain embryos in different stages of development and measure 32 by 12 to 15 microns.

The male worm resembles a thin strand of catgut and measures from 8 to 12 centimetres in length by 300 microns in thickness. The head, which measures 105 microns, is separated by a very short and slightly marked constriction from the body. The caudal extremity of the body is very slender and is shaped like a corkscrew with three turns.

The presence of the adult worms in the testicles does not apear to give rise to any symptoms. The pathogenic rôle of the larvae has not yet been investigated.

The author suggests the name *Filaria haematica cameli* for the parasite.

(66) Pricolo (A.) **Strongle capillaire du Chameau.** [Strongylus of the Camel.]—*Centralbl. f. Bakt.* 1. Abt., Orig. 1913. Oct. 4. Vol. 71. No. 2/3. pp. 201-202.

The author has found this parasite in the small intestine of camels in Tripoli.

The males and females are about the same size with the exception that the posterior portion of the male is a little more slender than the corresponding portion of the female.

The worm measures from 5 to 7 millimetres in length and it gradually increases in thickness from the head, which measures about 18 microns, to a maximum of 100 microns, which it attains close to the posterior extremity of the body. The female ends in a short cone. Occasionally there is a small appendage resembling a wing on either side of the head.

The head is curled round in a hook-like manner, but this is probably a post-mortem change. The mouth is unarmed. The uterus appears

to be straight and single, and the eggs which are double-contoured measure 90 by 45 microns.

The anterior extremity of the male worm is not hook-like. At a point 10 microns in front of the bursa is situated the anus which has a brown colour and is shaped like a fork with three prongs. The posterior prong is slender and cylindrical and is directed towards the bursa and terminates in a kind of knob. The two posterior (anterior ?) prongs are wide and flattened, and are directed forwards enclosing a space which is divided into two by two small appendages attached to the anterior prongs.

The worm appears to be of very constant occurrence in the small intestine of the camel, as the author has found it whenever he has made a search. It is frequently associated with haemorrhages, hyperaemia and catarrh of the mucous membrane.

Possibly the worm is that which has been described under the name *Strongylus instabilis* in other mammals.

ANTHRAX.

(67) HOLMES (J. D. E.). **A Note on the McFadyean Staining Reaction for Anthrax Bacilli.**—*Agricultural Research Institute, Pusa, Bulletin* No. 36. 1913. pp. 1–3. With 1 plate. (Superintendent Government Printing, Calcutta.)

The author shews that the view expressed by MITTER (*Jl. Trop. Vet. Sci.* Vol. 4, No. 1, pp. 68–70) regarding a supposed difference between the staining reactions of anthrax bacilli in Bengal and in Europe is incorrect, the probability being that the technique of the McFadyean method of staining was incorrectly carried out.

(68) HOWARD (G. G.). **Anthrax in Elephants.**—*Vet. Record.* 1913. Aug. 2. Vol. 26. No. 1308. pp. 69-71.

This note describes briefly outbreaks in two herds and the author explains that the brief nature of the record is due to the difficulties in the way of obtaining a more detailed one.

The animals involved in the outbreak lived entirely in the jungle at distances varying from 2 to 12 days march from headquarters. During the " off " season (March, April, and May) they are caught once daily and brought into camp for inspection by the head rider and then released again to graze.

At the commencement of the outbreak three animals died and the diagnosis was made upon the examination of blood smears forwarded to headquarters. After forced marching the author arrived at the infected area on the following day and found another animal shewing signs of illness. The animal was dull and had a haggard look. There was a swelling on the right side just below the scapula which was hot and painful. Examination of the blood while the animal was still alive shewed that a few anthrax bacilli were present in it. The animal died early the following morning, six hours after the bacilli had been found in the blood, and at the time of death bacilli were very numerously present.

The same day another animal was observed to be dull, and to have

a watery discharge from the eyes. In this case also there was a small well-defined swelling below the right scapula resulting in lameness. In both of these animals it was impossible to get any temperature taken on account of their viciousness. The swelling was continuously fomented with hot water and on the fourth day it burst in three places. Bacilli were not found in this animal's blood, and although the animal lost greatly in condition it eventually recovered. On the day that this animal was first observed to be ill another elephant shewed symptoms and it died on the following day, anthrax being confirmed by microscopic examination. Three days later another animal died of anthrax and one other became ill but recovered. In four of the animals there was a swelling on the right side.

RABIES.

(69) NOGUCHI (H.). **Contribution to the Cultivation of the Parasite of Rabies.**—*Jl. Experimental Med.* 1913. Sept. Vol. 18. No. 3. pp. 314-316. With 1 plate.

This paper contains a brief account of what the author claims to be the parasite of rabies in artificial cultures. The method employed was that used for the cultivation of the spirochaete of relapsing fever.

In cultures made either from the "street," "passage," or "fixed" virus minute granular and coarser pleomorphic chromatoid bodies make their appearance and these can be found in sub-cultures through many generations. The smallest of these bodies are just on the borders of visibility with a 2 mm. lens. On a number of occasions the author has observed in certain cultures rounded or oval nucleated structures provided with an enclosing membrane and quite different in appearance from the granular bodies. The appearance of these bodies in the cultures was sudden and after persisting for four or five days they disappeared, their disappearance coinciding with an increase in the number of small granular bodies.

Experimental inoculation of dogs, rabbits, and guinea-pigs with cultures containing the nucleated or the granular bodies has given rise to rabies, as shewn by the typical symptoms and positive animal inoculations, the granular and nucleated bodies being found in the brains of the animals so infected.

A paper substantially the same as this appears in the *Revue Vétérinaire*, 1913. Oct. Vol. 30, No. 10, pp. 592–595.

(70) LEVADITI (C.). **Virus Rabique et Culture des Cellules "in vitro."** [The Virus of Rabies and the Cultivation of the Cellules in vitro.] —*Compt. Rend. Soc. Biol.* 1913. Dec. 12. Vol. 75. No. 35. p. 505.

In this preliminary note the author states that using the technique of BURROWS, HARRISON and CARREL he has succeeded in cultivating spinal gangalia of rabid monkeys in monkey plasma. The pieces have been transferred to fresh plasma regularly every five or six days. It has been found that the virus of rabies preserves its virulence for the rabbit for at least a month at 37° C. Rabbits inoculated at each passage with portions of the cultivated ganglia have contracted rabies.

The two rabbits inoculated into the brain with the virus of the 5th passage and after thirty days cultivation became rabid on the 10th and 11th days.

Full details regarding the technique and the results of microscopic examination will be given in a future paper.

(71) Luzzani (Mme L. N.). **Le Diagnostic de la Rage par la Démonstration du Parasite Spécifique. Resultats de Dix Ans d'Expériences. (Première Partie.)** [The Diagnosis of Rabies by the Demonstration of the Specific Parasite (First Part.)]—*Ann. Inst. Pasteur.* 1913. Nov. Vol. 27. No. 11. pp. 907-924.

This article contains the author's views regarding the parasitic nature of Negri bodies and a brief description of a process of spore formation in which the central nucleus divides into a number of pieces, each of which has separated off round it a portion of the general body substance. The bulk of the paper is made up of a summary of the reports and statistics published by a large number of authors and a repetition of the various methods of staining that have been devised for the demonstration of Negri bodies. It is stated that while in cases of furious rabies the bodies are to be found in Ammon's horn, the cerebral cortex and cerebellum, in cases of dumb rabies they may be absent from these situations but present in the spinal ganglia and spinal cord.

(72) Luzzani (Mme L. N.). **Le Diagnostic de la Rage par la Démonstration du Parasite Spécifique. (Deuxième Partie.)** [The Diagnosis of Rabies by the Demonstration of the Specific Parasite. (Second Part.)]—*Ann. Inst. Pasteur.* 1913. Dec. Vol. 27. No. 12. pp. 1039-1062.

The author advises the adoption of the following procedure for the detection of Negri bodies in suspected material. In any case the hippocampus should first be examined if that be available. Transverse sections are cut from the fresh specimen and scrapings are taken from the cut surface. These are examined in the moist state without staining by spreading them out on a slide with a little dilute acetic acid. A plate is given shewing the appearance presented by the nerve cells containing the bodies.

Should this method fail, a thin slice of the hippocampus is fixed in Zenker's fluid for four hours and then washed in water, after which scrapings are taken from the cut surface and treated in the same manner as the fresh specimens. In the event of a negative result the thin slices are rapidly dehydrated and passed through chloroform and embedded in paraffin. The sections are stained by Mann's method.

Reference is then made to cell inclusions other than Negri bodies and the literature concerning them is discussed at some length. The characters of those found in cases of distemper are contrasted with those found in rabies.

The author draws attention to the discovery in the cells of the hippocampus and of the cerebellum of small cell inclusions in the brains of healthy cats. These stain red with Mann's method, but they have not the typical structure of Negri bodies.

The paper includes tabulated results of examinations made by the author.

(73) BERTARELLI (E.) & MELLI (C.). **Experimentelle Untersuchungen über die Pseudolyssa.** [Experimental Investigations regarding False Rabies.]—*Centralbl. f. Bakt.* 1. Abt., Orig. 1913. Oct. 11. Vol. 71. No. 4. pp. 286-291.

The following points were investigated by the authors :—

1. The filtrability of the virus.
2. The infectivity of the peripheral nerves.
3. Whether the virus can pass along the course of nerves.
4. Whether cell inclusions comparable to those found in rabies occur in the nerve cells of the central nervous system and spinal ganglia.

The only one of these points which has already received attention at the hands of experimenters is the first.

The virus used was obtained from CARINI.

In the first filtration experiment the brain of a rabbit infected by subcutaneous inoculation was mixed with 10 cc. of physiological salt solution and filtered at a pressure of one atmosphere through a new Berkefeld filter which had been tested with *B. prodigiosus.* Two rabbits inoculated respectively subcutaneously and subdurally with the filtrate failed to become infected.

In the second filtration experiment the " virus " was macerated for several hours in salt solution and then greatly diluted (no details given). This liquid was filtered at $\frac{3}{4}$ atmosphere pressure. The filtrate was centrifuged and used to inoculate one rabbit intraperitoneally and another subdurally. In both cases the result was negative.

A portion of the sciatic nerve of a rabbit which had died three days after subcutaneous inoculation was ground up in a mortar with salt solution, the liquid being used to inoculate rabbits subcutaneously and intraperitoneally. Neither of the rabbits died.

Another rabbit was inoculated with a similar liquid prepared from the sciatic nerve of a rabbit which had died as a result of inoculation into the sciatic nerve of the opposite side. The result was again negative.

The experiment was repeated with the sciatic nerve taken from a dog which had died as the result of subcutaneous inoculation from a rabbit. In this case also the result was negative. From these experiments the conclusion is drawn that the peripheral nerves are non-infective, this being in marked contrast to what is the case in rabies.

To ascertain whether the virus traverses the course of the nerves an animal (species unstated) was inoculated into the sciatic nerve which had been exposed and isolated with pads of wool. Death occurred with typical symptoms two days later.

As soon after death as possible the inoculated nerve was removed, ground up with salt solution, and used for the subcutaneous inoculation of two rabbits. Both died of the disease. The brain of one of these rabbits proved infective when inoculated into another animal.

A rabbit inoculated into the sciatic nerve which had been ligatured above the seat of inoculation failed to become infected. The same result was obtained when a rabbit was inoculated from a portion of

the sciatic nerve cut out above the seat of inoculation immediately after the inoculation had been performed.

Infection followed the inoculation of a very small quantity of virus into the muscle of the gluteal region which was exposed for the inoculation in order to avoid injuring any nerve trunk.

The conclusion that naturally follows from these results is that the virus can become disseminated not only along the course of nerves but in some other manner also. Some of the experiments suggest, however, that the dissemination of the virus along the nerve trunks is specific as is the case in rabies. It is said to be possible that the dissemination of small quantities may take place through other channels.

The authors have examined the brain of only one dog with the object of ascertaining whether bodies resembling Negri bodies are present, and only a single body in any way resembling a Negri body was found.

RINDERPEST.

(74) Braddon (W. L.). **Some Peculiar and Probably Specific Bodies in the Erythrocytes in Rinderpest and another Allied Disease.**—*Parasitology.* 1913. Oct. Vol. 6. No. 3. pp. 265-275. With 1 plate.

The author's observations were made in connection with the production of a protective serum for buffaloes in the Malay States.

For the detection of the bodies described a special method of treating the blood is essential, the method being one which the author has been in the habit of using for blood-studies.

Method. The blood is diluted with a mixture containing 1 per cent. of citrate of potash and 0·5 per cent. of ordinary medicinal methylene blue. Different proportions of the fluid must be added varying from one-fifth to one-third of the volume of blood, according to the condition of the latter, which as taken from the vein may be almost tarry or excessively hydraemic.

" Of the mixture, some specimens are put up under cover-glasses, sealed at the edges with a paraffin of low melting-point; other portions are put in watch glasses exposed to the air, but not to light, and are kept in Petri dishes arranged as moist chambers. When examination reveals the presence of the specific bodies in these preparations, films may be spread in the ordinary way, and fixed as permanent specimens."

Appearances presented by the bodies. After a period varying from 6 to 48 hours there appears upon the blood corpuscle a blue point, from which there later develop one or more delicate fine lines going deeper into the corpuscle. These lines by extending and thickening usually demarcate a long slender needle- or sword-shaped body which may extend into, across, or through the corpuscle.

The bodies may be straight or curved, may present a single or double contour and may vary considerably in width. The ends may be pointed or oval. In some cases the protruding ends of the bodies carry the membrane of the corpuscle with them. The bodies may appear to be in one plane, bent, twisted, or folded. A single cell may contain one or more such bodies.

The bodies may be completely extruded from the corpuscles, and many filamentous and lanceolate forms may be seen either attached by one end to the corpuscle or free in the plasma.

In specimens taken from acute cases when near the crisis none of these forms may be found, but corpuscles shewing a minute speckling with blue points may be seen. In a small number of corpuscles fewer granules of a larger size may be observed, and in some of these the granules may have a comma-like form.

The presence of the endoglobular bodies is indicated in the author's opinion in other ways. The blood corpuscles undergo an alteration of outline, appearing as though a slice of variable size had been cut off from one side. Measurement is said to shew that there is in reality no loss of substance, but that the alteration of shape is due to some pressure exerted by a body within the corpuscle. The author has been unable to demonstrate this body within the corpuscle by staining.

Movements. Within the first 24 hours of observation corpuscles and particularly those which appear to have had a portion sliced from them shew active movement. Rapid oscillations lasting for a short time are combined with rotatory changes in position. The effect is an exaggerated Brownian movement, and the corpuscles actively jostle one another.

Within the corpuscles, even when in a fairly advanced stage of staining and after several days of observation, the bodies shew movements of their own. They bend and unbend, twist or rotate sluggishly on their long axis, change position within the corpuscles; when attached by one extremity to the exterior of the corpuscle they sway freely in the plasma and vibrate with a limited range. The free forms move through the plasma shewing movements of rotation, bending and unbending.

Relation to disease. The bodies have been found invariably in all cases of acute rinderpest during the febrile stages, and in the great majority of cases up to eight months after recovery.

In artificially infected animals which have first been proved to be free of these forms they appear as early as the third day after inoculation. From this date they increase rapidly in numbers, and even in serum-protected animals three-quarters of the corpuscles may become invaded. Their appearance precedes the onset of pyrexia by several days and thus forms a valuable means of detecting contacts.

In animals less susceptible than buffaloes the bodies are smaller, less numerous, and less active. In successive reactions following the injection of virus into immunised animals there is also a progressive diminution in number and size.

In one of two domestic pigs inoculated numerous slender forms were found in the blood on the fourth day. In goats which act as passive carriers of the virus (which in them is active from the 4th to the 8th day after inoculation), the bodies could not be distinguished in any of the shapes occurring in cattle, but tapering filaments were observed to be protruding from opposite sides of the corpuscles, and these were observed to continue unaltered in shape for ten days or more.

A *New Rinderpest-like Malady.* The author's attention was drawn to a disease among buffaloes which resembled rinderpest in its clinical features and in the post-mortem findings, but which occurred as a limited epizootic and caused only a low mortality.

Examination of blood from these cases by the author's method failed to reveal the bodies observed in true rinderpest, but shewed an intracorpuscular body of a different kind.

In nearly every corpuscle a short thick rounded, ovoid, angular, or nearly square body could be seen. They stained of a dark green to a blue black colour and appeared to consist of a vesicle measuring from ½ to 3 microns in diameter distended with stain. They appeared to have a tendency to protrude from the corpuscles but none were found absolutely free.

Remarks as to technique. The only method by which the author has been able to stain more than the mere margins of the bodies is as follows:—The specimen, having had any excess of mercury (sublimate is the best fixative) and blue washed off, is immersed in the original solution for five minutes and overstained. It is then washed and treated for 10 seconds only with a mixture of 2 per cent. orange G., 1 per cent. Anilin blue, and 2 per cent. Oxalic acid in water. Wash quickly with water, absolute alcohol, acid alcohol, and again water. In successful specimens the corpuscles have a green tint and the specific bodies have a deep brown colour.

It appears to be essential that the stain in the first instance should be applied to the unfixed corpuscle.

(75) Johnson (J. C.). **Observations on Mammalian Erythrocytes.**—*Parasitology.* 1913. Oct. Vol. 6. No. 3. pp. 276-278.

The observations recorded in this short paper were carried out with the object of ascertaining whether any appearances resembling those described in Braddon's paper on rinderpest could be discovered in the blood of healthy and diseased animals.

Normal blood was examined from a man, two dogs, two rabbits, a white rat, a calf, and a ram. The diseased animals from which blood was taken for examination included a calf infected with *Theileria parva*, three dogs suffering from acute piroplasmosis, two dogs suffering from chronic piroplasmosis, and a horse "salted" against infection with *Nuttallia equi*.

Several specimens of blood were taken from each animal by running it into marked tubes containing Braddon's mixture, and in proportions varying from ⅙ to several times the volume of staining fluid.

With the blood of normal animals it was found that the quantity recommended by Braddon was insufficient to prevent coagulation.

Four methods of examination of the erythrocytes were adopted:

1. A drop of mixture from the tubes was transferred to a slide, covered, and ringed with vaseline.

2. Coverglass films were made from the mixtures, fixed wet over formalin, or with saturated mercuric chloride, and mounted in balsam.

3. Films of fresh blood were made at the time of collection, and treated with either Giemsa's or Leishman's stain.

4. For correlation with the above, unstained films were observed of the blood mixed with Hayem's solution.

A great many films had to be rejected owing to osmotic changes in the red blood corpuscles.

In specimens in which the mixtures were correctly made, so as to avoid change in the histological characters of the blood corpuscles, the solution recommended by Braddon was found to be an excellent preservative for blood films. Several ringed films kept in perfect condition for over a month.

After prolonged examination of many films the author concluded that:—

1. The appearances of the erythrocytes in the morbid conditions examined were easily differentiable from those described by BRADDON.

2. Normal blood corpuscles from the above sources presented nothing like his description of the alleged parasite of rinderpest, which tends to support his view that what he describes is specific to that disease.

MISCELLANEOUS.

(76) MINETT (E. P.). **Report of Epidemiological Survey and Investigation into Probable Causes of Sickness amongst Mules on Plantations Bath, Blairmont, Providence and Springlands, British Guiana.**—*Jl. Trop. Med. & Hyg.* 1913. Dec. 1. Vol. 16. No. 23. pp. 362-364.

The disease which is briefly described in this paper has been the cause of death of a number of horses and mules in the districts mentioned. The period of incubation is uncertain, but probably amounts to several weeks at the most. The symptoms are:—Loss of condition, progressive anaemia, paralysis of the hind quarters and in some cases haemoglobinuria. Jaundice was seldom observed. Acute cases terminate fatally in 3 weeks, while chronic ones may last for 6 months. The lesions found are as follows:—Anaemia of all the organs, haemorrhages under the serous membranes, no enlargement of the spleen. No trypanosomes were found and examination for meningococcus was negative. Sections of the spinal cord shewed a small amount of round-celled infiltration around the capillaries.

In a Supplementary Report on Mule and Horse Disease in the County of Berbice it is stated that smears of blood taken during the febrile period shewed large numbers of trypanosomes "closely resembling *T. equinum.*"

(77) HADWEN (S.). **On "Tick Paralysis" in Sheep and Man following Bites of *Dermacentor venustus*. With Notes on the Biology of the Tick.**—*Parasitology.* 1913. Oct. Vol. 6. No. 3. pp. 283-297. With 2 plates.

History of the disease. During the spring of the years 1910 to 1913 complaints were received from Keremeos, British Columbia, that a peculiar form of paralysis among sheep had been observed.

In 1911 an outbreak occurred among 900 sheep imported from Montana, and during March and the first week in April 46 old sheep were lost.

From March 1st to 15th 1912, 34 yearling sheep were affected and 10 died. In May, June and July about 300 were affected, and about 80 died. These is no definite information that these were affected in the same way, but it was said that they were suffering from a form of paralysis.

From March 25th to April 5th 1913 five yearlings were paralysed, but none died.

The author proceeded to the district in April, and though he saw no recent cases some which had been affected were shewn to him. The

animals had just been shorn and on examining one of them a large tick which had been cut in half was found attached to its back.

Surrounding the tick was a large discoloured area and this caused the suspicion that the disease was due to the bites of ticks.

Recently papers have been published recording the occurrence of a peculiar form of paralysis occurring in human beings as a result of tick bites.

On returning to Agassiz the author was able to reproduce the disease experimentally with ticks brought from the district where the naturally contracted cases had occurred.

In at least one instance it was found that the removal of a tick from an affected animal was followed by prompt recovery.

The explanation of the occurrence of a few cases only in lambs lies in the fact that by the time they are taken up to the hills the ticks have practically disappeared for the season.

The tick season around Keremeos may begin as early as February and does not extend much beyond May, but the author was informed that occasionally a few ticks were observed on sheep during the autumn and that cases were sometimes encountered during that part of the year.

Nature of the disease and symptoms presented. The disease occurs in sheep and man, and probably in other species also, and is caused by the bite of *Dermacentor venustus*.

The tick has a decided preference for biting along the spinal column, but it remains to be shewn whether the disease is produced by the bites of the tick on any other portion of the body. The tick certainly produces serious local effects wherever it may bite.

The disease is said in some cases to last for months.

Reports have been received regarding the occurrence of a disease of the same or a similar nature in colts, dogs, rabbits and grouse.

In the sheep symptoms of paralysis occur in from 6 to 7 days after the ticks have become attached to them, and the only lesions found at the post-mortem are subcutaneous haemorrhages where the ticks have been attached and congestion of the brain and cord. Attempts to transmit the disease by inoculation have failed and no parasites have been discovered in the blood or nerve tissues.

Broth cultures prepared from diseased animals have remained sterile. The probable explanation of the disease is that it is due to toxins injected by the ticks and that these are elaborated at a time when engorging is rapid, that is 24 hours before the ticks drop off.

The average time occupied by female ticks in becoming engorged was $6\frac{1}{2}$ days.

The period of incubation suggests that the disease may be of microbic origin and it is possible that the causal agent has not been recognised, but the fact that no fever has been recorded and inoculation experiments have proved negative rather contra-indicates this.

The fact that old sheep were attacked during the first year and that only yearlings were subsequently diseased suggests that an attack of the disease confers immunity. This does not interfere with the toxin theory of the disease.

So far there seems to be no evidence connecting the paralysis observed among the sheep with Rocky Mountain fever, the only other disease transmitted by *D. venustus.*

The disease develops somewhat slowly and in cases where recovery is about to take place the first stages towards recovery also are prolonged, after which progress is rapid.

It is suggested that the removal of ticks and dipping would prove of benefit in the treatment of the disease.

The male ticks attach and detach themselves, causing haemorrhage at every bite. The blood seems to have lost its power of coagulation.

Position of ticks on the host. In the immense majority of cases the ticks are situated along the line of the spinal column, both in the natural and in the experimental cases.

The following are given as probable reasons why the ticks select the line of the back as their point of attachment :—

1. There is frequently a parting in the wool along the back.
2. The ticks are likely to be brushed off on to the back when the animals pass under bushes.
3. All the denuded portions of a sheep's body are greasy.
4. The wool is very thick on all other parts of the body except on the brisket where ticks are occasionally found.

In animals other than sheep, including man, the favourite seat of attachment appears to be the neck, but in horses they are found in the perineal region also.

Of 87 ticks collected from sheep 53 were females and 34 males.

In view of the fact that the male tick frequently attaches itself without any females being present, it is more dangerous than the male of any other species—if the male is capable of producing the disease, a point which requires elucidation.

(78) Hadwen (S.) & Nuttall (G. H. F.). **Experimental "Tick Paralysis" in the Dog.**—*Parasitology.* 1913. Oct. Vol. 6. No. 3. pp. 298-301.

The dog used in this experiment had been used fourteen months previously for a piroplasmosis experiment, and had made a complete recovery after treatment with trypanblue.

The ticks used were collected in June 1913 and on July 8th a single female was placed upon the dog. On the following day the tick attached itself on the right side of the neck just in front of a line joining the scapular angles. On the ninth day symptoms of paralysis appeared, the hind quarters being affected. Sensation in the hind legs was unimpaired. On the following day the fore limbs were affected, and the dog could only raise its head a little. There was incontinence of urine and loss of appetite. During the next three days the breathing was laboured and the animal had to be fed, the paralysis persisting. From the 14th day the symptoms began to subside and by the 16th day the dog was as well as ever. On the 18th day the tick was removed about two-thirds engorged.

On July 25th a single female was placed each upon a horse and a jackal. Both ticks attached themselves, but did not engorge to repletion and failed to produce any effects.

In 1912 a number of experiments were carried out with guinea-pigs and some ticks obtained from eggs of *D. venustus.*

In the first experiment larvae and then nymphs were placed upon guinea-pigs, but the result was entirely negative.

In the second experiment larvae were placed on a guinea-pig and they dropped off engorged in from 3 to 6 days. Eight days later nymphs began to emerge. These were placed upon a guinea-pig which died on the 6th day after their application.

In the third experiment larvae were placed upon a guinea-pig which died on the 5th day. Some of the nymphs obtained were placed upon a guinea-pig which died on the 7th day. Others were placed upon a ram's scrotum without producing any effect. The adults were also without any effect when placed upon a ram's scrotum.

(79) WILLIAMS (A. J.). **Notes on an Outbreak of Horse Sickness connected with the Presence of Lyperosia as a possible Transmitter.** —*Veterinary Jl.* 1913. Aug. Vol. 69. No. 458. pp. 382-386

In this article the author describes the occurrence of an outbreak of horse sickness under conditions which suggested that Lyperosia might be the transmitting agent. The cases occurred at Dilling and later at El Obeid, in November and December 1908.

The first two cases occurred in animals that had been at Dilling for some time, and the subsequent cases among the horses of a squadron of cavalry whch had arrived there from Kordofan.

The first case occurred among the cavalry horses on the 6th day after the first horse died and the 7th after their arrival. The second case in this batch of animals occurred a week later.

The horses were then moved to El Obeid, ninety miles away. There seven cases occurred and it appeared to be probable that in five of these the infection was contracted before the horses left Dilling. After their departure for El Obeid three further cases occurred at Dilling, making 14 in all.

Attention is drawn to the following points:—

No cases occurred among horses purchased locally. The symptoms and course of the disease were absolutely typical. Horse sickness is known by the Arabs to occur in the district, which is sandy and desert-like, and where during the dry season water is obtained from wells 60 feet deep. The disease is known to make its appearance with the first rains and to disappear with the onset of the cold season. Enquiries shewed that several cases had occurred in the locality and it was considered to be unusual that cases should occur so late in the year.

There were no mosquitoes in the district, and the only biting fly found was *Lyperosia minuta*, and the author thinks that taking all the circumstances into consideration it appears to be not improbable that this fly was the transmitting agent, carrying the infection directly from horse to horse.

(80) KUHN (P.). **Bemerkungen zu der Arbeit von Dr. H. Sieber "Experimentelle Untersuchungen über die Pferdesterbe."** [Observations on Dr. Sieber's Article "Experiments in connection with Horse Sickness."]—*Zeitschr. f. Infektionskrankh. parasit. Krankh. u. Hyg. d. Haust.* 1913. Oct. Vol. 14. No. 4/5. pp. 316-320.

This paper contains some criticisms of an article published by SIEBER in the same journal in 1911 (Vol. 10, No. 2/3).

(81) JOWETT (W.). **Pulmonary Mycosis in the Ostrich.**—*Jl. Comp. Path. & Therap.* 1913. Sept. Vol. 26. No. 3. pp. 253-257. With 1 text-fig.

Although the author was unable to carry out experiments to identify the causal organism encountered in the lesions described in this article, the fact that the lesions differed markedly from those encountered by ARCHIBALD in the Sudan (see this *Bulletin* Vol. 1, No. 5, 1913, p. 316) appeared to warrant the publication of a note.

The cases occurred in birds from three to five years old and the period of visible illness was probably very short, though no definite information was forthcoming on this point. The lesions were found in the lung tissue only, the trachea and bronchi being free from macroscopic alterations. The lungs were congested and hepatised, and on section were found to be crowded with small yellowish tubercles rather larger than pins' heads. The tubercles were shot-like in consistence and could not be enucleated from the surrounding lung tissue.

On section they were found to be composed of three zones—a central necrotic zone containing numbers of thick-walled, branching, segmented filaments, a middle zone composed of leucocytes and epitheloid cells, through which many mycelial filaments passed in a radiating manner, and a peripheral zone in which the lung tissue shewed evidence of croupous inflammation.

The filaments measured from 2 to 4 microns in diameter and the older ones, which had very thick walls, resisted the penetration of stains. Free spores were fairly numerous and measured up to 4 microns in diameter.

" Mouldy " grape husks were thought to have been the vehicle of infection.

(82) VINCENZO (Z.). **Sul *Criptococcus farciminosus* di Rivolta.** [The Cryptococcus of Rivolta.]—*Il Moderno Zooiatro.* Parte Scientifica. 1913. Sept. 30. Vol. 24. No. 9. pp. 381-385.

This paper contains a general survey of the author's observations regarding the nature of the organism, and he concludes that the parasite is not a protozoon but that it belongs to the saccharomycetes.

(83) MARSHALL (C. H.). **Experiments with the *Micrococcus melitensis*.** —*Jl. London School Trop. Med.* 1913. Nov. Vol. 2. No. 3. pp. 220-223.

This short paper contains the records of a few experiments carried out with the object of increasing the virulence of the organism and to test the effect of " 606 " upon the course of the disease.

The author's conclusions are as follows :—

A few passages of the *Micrococcus melitensis* through the guinea-pig are insufficient to naturally increase the virulence for that animal.

The slightly increased virulence obtained by a few passages of the organism through guinea-pigs does not increase the virulence of the strain for rabbits.

The injection of " 606 " appears to have a definite inhibitory effect on *M. melitensis* when injected into the experimental animal shortly after inoculation with the organism.

When the original dose of " 606 " is insufficient to prevent infection a subsequent dose appears to have a definite curative effect.

REPORTS.

(84) NYASALAND PROTECTORATE. **Annual Report on the Department of Agriculture for the Year ending March 31, 1913. Veterinary Division.** (GARDEN, E.)—Zomba: Printed at the Government Press. [Price 6d.]

This report deals with (1) The Veterinary Congress on Rinderpest held at Bulawayo (the resolutions passed are printed verbatim), (2) Trypanosomiasis, (3) Piroplasmosis, (4) Demodectic Mange, (5) Black Quarter, (6) Ophthalmia in Cattle, (7) Swine Fever, and (8) Dipping. The specimens examined during the year are given in a tabular statement.

Four outbreaks of trypanosomiasis are recorded, principally on or near the Zomba-Blantyre Road. No details regarding the magnitude of the outbreaks or the causal trypanosome are given.

Theileria parva is known to occur in the Protectorate and the presence of *B. mutans* is strongly suspected.

The spread of demodectic mange among [cattle has rendered notification necessary. Slaughtering of the affected and regular dipping of the whole herd is advocated as the only means of eradicating the disease.

Although the presence of Black quarter in the Protectorate is suspected, proof of its existence has not yet been furnished.

Two forms of ophthalmia in cattle are met with, viz., " Specific " which has been dealt with in a previous report, and " Verminous."

Verminous ophthalmia is caused by nematode worms which measure 10–14 mm. (female) and 20–24 mm. (male) in length.

" The parasites are readily seen gliding over the surface of the eye and in between the folds of the mucous membrane."

They are often found in tangled masses under the membrana nictitans.

Swine Fever made its appearance in the Protectorate in October 1912, the infection being traceable to Rhodesia. Fortunately the area involved was restricted, and owing to the villages being widely separated the disease died out.

Attention is emphatically drawn to the necessity of establishing tanks and undertaking systematic dipping for the eradication of ticks and tick-borne diseases.

(85) SOUTHERN RHODESIA. **Report of the Chief Veterinary Surgeon** (SINCLAIR, J. M.) **for the Year 1912.**

African Coast Fever. During the year five outbreaks occurred, as compared with eight in 1911 and eighteen in 1910. The total mortality including animals slaughtered on account of a rise of temperature was 505. Of these 409 occurred at one centre.

Dipping has been found to be of immense value in controlling this and other diseases. The value of the method of dealing with the disease is evidenced by an account of the occurrence of the disease on the Umtali commonage. After a period of freedom lasting for several years a case occurred in January 1910. Three-day dipping was

resorted to and, although the cattle were not removed from the infected veldt, only four further deaths have occurred in two years.

Contagious Pleuro-pneumonia. A single case of this disease occurred at a farm close to the Bechuanaland Protectorate border, and since the last case of the disease recorded in the whole Territory occurred in 1904 it appears to be probable that it was introduced from Bechuanaland where it has existed for years. Quarantine and restriction of movement regulations were in force for three months and no further outbreaks occurred.

Anthrax. Two outbreaks occurred involving the loss of fourteen pigs, one donkey, and six head of cattle. The only record of a previous outbreak of anthrax in Southern Rhodesia is that which occurred at Ramaquabane in 1898.

Bovine Plasmoses. The immunity conferred by an attack of redwater gradually declines unless reinforced by constant re-infection by means of ticks. It has been observed that the dipping practised for the eradication of African Coast Fever has resulted in a decrease in the immunity against redwater and gall-sickness (anaplasmosis). It has also been observed that the strain of anaplasma has increased in virulence during the last year or two.

In order to establish immunity in imported stock the local virus must be used. The virus obtained from Pretoria did not confer complete immunity.

Black Quarter. No recurrence of the disease is reported.

Ovine anaplasmosis. The existence of this disease in various districts throughout the Territory has been demonstrated. The symptoms are anaemia, cachexia, and oedema of the intermaxillary space (bottle jaw).

Trypanosomiasis. Although tsetse fly exist to a considerable extent in the Sebungwe, Lomagundi, and Hartley districts, the diseases transmitted by them to domesticated animals are not of great economic importance from a veterinary point of view.

The only outbreak of any importance recorded during the year was the loss of 20 head of native cattle in the Sebungwe district. It is only in grossly infested areas that stock farming is impossible. Encouraging results have been obtained in the treatment of trypanosomiasis by the Veterinary Bacteriologist (BEVAN), but it is not thought advisable to publish an account of the method of treatment at present.

Importation of cattle from North-Eastern Rhodesia was suspended owing to the possibility that the animals might convey the human trypanosome, and it was suspended from North Western Rhodesia on account of the existence of "Shesheke cattle sickness" which appears to be a fatal form of trypanosomiasis occurring in an area free from tsetse flies.

Rabies. Outbreaks have occurred in eight or nine districts, but no figures are given. It is said that there is good reason for believing that the disease exists among the wild carnivora.

Horse Sickness. No statistics are available, but not more than a dozen deaths were reported.

(86) SOUTHERN RHODESIA. **Report of Veterinary Bacteriologist (BEVAN, Ll. E. W.) for the Year 1912.**

Bovine Plasmoses. See Abstract 478, Vol. 1 of this *Bulletin.*

Horse Sickness. Experiments regarding immunisation against this disease have been carried out on fifteen animals and seven of these have withstood inoculation with virus.

Trypanosomiasis. See Abstract 487, Vol. 1 of this *Bulletin.*

In that abstract it is stated that further reference will be made to the trypanosomes appearing in two of the rabbits inoculated.

These rabbits were inoculated, one from a dog and one from a sheep, and a trypanosome of the *pecorum* type made its appearance in the blood. These trypanosomes were carried on in sub-inoculations.

A number of cattle were detained at Feira on account of the possibility of their conveying human trypanosomiasis. Three dogs and nine sheep were inoculated from them. Two of the dogs died of an infection of the *pecorum* type in 28 and 44 days. Four sheep became infected with a mild disease caused by a trypanosome of the same type. " In none of the animals have trypanosomes of the nagana type been encountered. In view of the large percentage of buck found by Kinghorn and Yorke to be infected with the so-called *T. rhodesiense* in the Luangwa Valley, this result is somewhat significant."

(87) UGANDA PROTECTORATE. **Annual Report of the Department of Agriculture for the Year ended March 31, 1913.** Report of the Chief Veterinary Officer (HUTCHINS, E.), 1913. Kampala: Printed by the Uganda Company Press.

East Coast Fever. Owing to pressure of other duties little has been done during the year regarding this disease save mapping out areas in which it is endemic.

Rinderpest. During the year rather over 38,000 cattle in the Eastern Province were immunised against this disease. Approximately 30,000 of these were treated by the mixed method, a dose of virulent blood being administered at the same time as protective serum. The mortality seldom exceeded 5 per cent.

Trypanosomiasis. T. pecorum is responsible for the heaviest losses. In certain districts half the affected herds were carried off by the disease and there appears to be good reason for believing that in Bugerere and Buruli the disease is of recent introduction. The Eastern Province is particularly free from trypanosome infection but so far as is known there is nothing in the distribution of the biting flies which would account for this, but possibly the absence of big game is the real explanation.

Epizootic lymphangitis is widely prevalent and it is said that it can be arrested if treatment is undertaken in time, but it is doubtful if a permanent cure is ever effected.

Two fatal cases of horse sickness were seen during the year.

Restrictions have been imposed upon imported dogs, as rabies has been reported as occurring in jackals in British East Africa.

Trypanblue has proved to be effectual in the treatment of the majority of cases of piroplasmosis in the dog.

(88) UGANDA PROTECTORATE. **Report of the Tour in South Africa, undertaken by** RICHARDSON (U.F.), **Veterinary Officer.** [MS.]

The tour described in this report was undertaken for the purpose of studying (1) East Coast Fever, particularly methods of inocula-

tion. (2) Trypanosomiasis. (3) Diseases of stock occurring in South Africa which may become of economic importance in Uganda. (4) South African methods of regulating cattle transport.

East Coast Fever. The importance of this disease in Uganda lies in the facts that: (1) There are parts of the country which have never suffered from the disease and others in which it is endemic, and cattle removed from the one to the other die from it. (2) In some parts of the country the raising of young stock is severely handicapped by East Coast Fever occurring in young calves (Amakebbe) and causing a mortality of from 1 to 80 per cent., according to the district. (3) Imported cattle quickly die of the disease. Reference is made to the procedures adopted in Southern Rhodesia and the Union of South Africa for dealing with the disease. In the former quarantine, movements of cattle to clean pastures and dipping are said to have given fairly satisfactory results. The same plan associated with slaughter of affected animals is giving good results in the Union. It is suggested that where dipping is found unsatisfactory it is probably due to want of care. Inoculation with spleen and gland pulp is said to give very irregular results, the reason for which is unknown.

Pulp made from the organs of an animal actually dying from the disease is believed by the officers in the field to be too powerful a material to be used as a vaccine. It is believed that the best material is obtained from an animal just after the remission of temperature. Richardson believes that inoculation might be resorted to with advantage in Uganda, but that it does not appear to offer much hope of dealing with Amakebbe.

Trypanosomiasis. With regard to the transmission of trypanosomiasis, it is said to be the general opinion of veterinary officers in Portuguese East Africa and Rhodesia that permanent fly areas are kept infective by tsetse flies, and that cattle which have become infected in these areas act as reservoirs outside the fly belts, the transmitting agents there being Tabanidae.

BOOK REVIEW.

(89) Holmes (Major J. D. E.). [M.A., D.Sc., M.R.C.V.S., Imperial Bacteriologist.] **A Description of the Imperial Bacteriological Laboratory, Muktesar; Its Work and Products.** 47 pp. With 33 plates. 1913. Superintendent Government Printing. Calcutta. India. [Price 8 annas, or 9 pence.]

This little volume is full of interest and instruction, particularly to those who have not had the opportunity of working in India. The difficulties encountered in the application in the field of the results of the laboratory investigations are clearly shewn, and the manner in which these difficulties have been overcome to a great extent plainly indicates the value of the laboratory work.

The book is divided into five chapters dealing with (1) A Short History of the Laboratory, (2) A Description of the Laboratory Site and Buildings, (3) The Research Work and Publications of the Laboratory, (4) The Practical Application of Serum and Vaccines, and (5) The Products of the Laboratory.

The chapter on the Research Work and publications will be found of great value when it is desired to refer to the literature concerning the diseases of stock in India.

Chapters 4 and 5 deal in a concise manner with the preparation and practical application of the various sera and vaccines prepared at the laboratory, and it is from these chapters particularly that a clear idea is obtained of the immense difficulties that have been and are being overcome.

The half-tone plates give an excellent idea of the general arrangement of the laboratory and its equipment, shewing especially the size to which the Station, which was opened in 1895 with a laboratory, post-mortem house, cattle shed, bungalow, and cattle-kraal, has grown.

RECENT LITERATURE.

[Continued from *Bulletin* Vol. 1, No. 5, pp. 321-326.]

Babesiasis (Piroplasmosis).

(90) MARTOGLIO (F.), STELLA (V.), & PROVENZALE (F.). Sulla Recettività dei Bovini somali verso il *Piroplasma bigeminum*.—*Ann. d'Igiene Sperimentale*, 1913. Vol. 23. (New Ser.). No. 3, pp. 315–324. With 3 charts.

(91) NUTTALL (George H. F.). The Herter Lectures. III. Piroplasmosis.—*Parasitology*, 1913. Oct. Vol. 6. No. 3, pp. 302–320. With 14 text figs.

(92) SABRAZÈS (J.) & BONDEAUD (Aug.). Note sur Quelques Cas Piroplasmose canine observés dans le Sud-Ouest de la France.—*Gaz. Hebdomadaire des Sci. Med. de Bordeaux*, 1913. Oct. 12. Vol. 34. No. 41, pp. 490–491.

(93) THOMSON (J. G.), & FANTHAM (H. B). The Culture of *Babesia* (*Piroplasma*) *canis* in Vitro.—*Ann. Trop. Med. and Parasit.* 1913. Dec. Vol. 7. No. 4, pp. 621–630. With 5 text figs. and 1 plate.

Epizootic lymphangitis.

(94) HARBER (A. F.). Epizootic Lymphangitis and its Treatment.—*Veterinary Jl.*, 1913. Sept. Vol. 69. No. 459, pp. 408–414.

(95) KENNEDY (W.). Epizootic Lymphangitis.—*Agric. Jl. of B. E. Africa*, 1913. March. Vol. 5. Part 1, pp. 43–47.

Filariasis.

(96) STEFKO (W.). La Filariose des Oiseaux de la Russie Centrale.—*Bull. Soc. Path. Exot.*, 1913. Oct. Vol. 6. No. 8, pp. 592–594.

Leishmaniasis.

(97) CANNATA (S.). Sul Reperto del Parassita di Leishman nel Sangue periferico. [The Detection of Leishmania in the Peripheral Blood].—*Malaria e Malat. d. Paesi Caldi*, 1913. Aug.-[Sept. Vol. 4. No. 5, pp. 303–306.

(98) CARONIA (G.). Sul Potere complementare del Siero di Sangue nella Leishmaniosi infantile. [The Complement Content of Blood Serum in Infantile Leishmaniasis.]—*Malaria e Malat. d. Paesi Caldi*, 1913. Aug.–Sept. Vol. 4. No. 5, pp. 309–313.

(99) SCORDO (F.). Alterazioni morfologiche dei Corpi del Leishman nel Kala-Azar. [Morphological Changes in Leishman's Bodies in Kala-Azar.]—*Malaria e Malat. d. Paesi Caldi*, 1913. Aug.–Sept. Vol. 4. No. 5, pp. 313–317.

(100) SPAGNOLIO (G.). Sul la Ganglio-puntura nella Diagnosi di Leishmaniosi. [Gland Puncture in the Diagnosis of Leishmaniasis.]—*Malaria e Malat. d. Paesi Caldi*, 1913. Aug.–Sept. Vol. 4. No. 5, pp. 306–308.

Rabies.

(101) MEJÍA (Carlos Ramos). Rabia y Salvarsan.—*Semana Medica*, 1913. Dec. 4. Vol. 20. No. 49 (No. 1038), pp. 1315–1318.

(102) MOON (V. H.). The Organism of Rabies and Experiments in its Artificial Cultivation.—*Jl. Infectious Diseases*, 1913. Sept. Vol. 13. No. 2, pp. 232-235.

(103) POOR (D. W.) & STEINHARDT (Edna). A Study of the Virus of Rabies, freed from the Cells of the Host and from Contaminating Organisms.—*Jl. Infectious Diseases*, 1913. Sept. Vol. 13. No. 2, pp. 203–231.

Rinderpest.

(104) HOLMES (J. D. E.). Rinderpest. Further Investigations on Questions connected with the Economical Production of Antiserum.—*Memoirs Dept. Agriculture in India.* Vet. Ser., 1913. Nov. Vol. 2. No. 2, pp. 33–80.

(105) OLIVER (E. W.). Note on Rinderpest.—*Bulletin* 28, *Agricultural Series.* Issued by the Dept. of Land Records and Agriculture, United Provinces of Agra and Oudh.

(106) WÖLFEL (K.). Rinderpest in Deutsch Ostafrika. [Rinderpest in German East Africa.]—*Zeitschr. f. Infektionskrankh. parasit. Krankh. u. Hyg. d. Haust.*, 1913. Dec. 24. Vol. 14. No. 7, pp. 429–457. With 1 map.

Spirochaetosis.

(107) KING (W. E.) & HOFFMANN (G. L.). *Spirochaeta suis*, its Significance as a Pathogenic Organism. Studies on Hog Cholera.—*Jl. Infectious Diseases*, 1913. Nov. Vol. 13. No. 3, pp. 461–498. With 1 plate and 3 text figs.

(108) LEBAILLY (C.). Sur les Spirochètes de l'Intestin des Oiseaux.—*Compt. Rend. Soc. Biol.*, 1913. Nov. 21. Vol. 75. No. 32, pp. 389–391.

(109) SWIFT (H. F.) & ELLIS (A. W. M.). A Study of the Spirochaeticidal Action of the Serum of Patients treated with Salvarsan.—*Jl. Experim. Med.*, 1913. Oct. Vol. 18. No. 4, pp. 435–449.

Trypanosomiasis.

(110) HOLMES (J. D. E.). A Further Note on the Cure of Surra in Horses.—*Indian Civil Vet. Dept. Memoirs.* No. 3, pp. 73–77.

(111) HOLMES (J. D. E.). Some Cases of Surra treated in the Field and in the Laboratory during the Autumn of 1911.—*Memoirs of the Dept. of Agriculture in India.* Veterinary Series, 1913. Aug. Vol. 2. No. 1, pp. 1–31.

(112) KLEINE (F. K.) & FISCHER (W.). Schlafkrankheit und Tsetsefliegen. II. Mitteilung. [Sleeping Sickness and Tsetse-flies.]—*Zeitschr. f. Hyg. u. Infektionskrankh.* 1913. Aug. 27. Vol. 75. No. 2, pp. 375–382.

Undulant Fever.

(113) SÈJOURNANT (J.). La Fièvre Mediterranéenne en Algérie en 1912. [Undulant Fever (Malta Fever) in Algeria in 1912.]—*Ann. Inst. Pasteur*, 1913. Oct. Vol. 27. No. 10, pp. 828–838.

Biting Insects.

Flies.

(114) CARPENTER (G. D. H.). Second Report on the Bionomics of *Glossina fuscipes* (*palpalis*) of Uganda.—*Report Sleeping Sickness Commission Roy. Soc.*, 1913. No. 14., pp. 1–37. With 36 figs.

(115) CHALMERS (A. J.) & KING (H. H.). The Distribution of *Glossina longipennis* (Corti, 1895).—*Jl. Trop. Med. and Hyg.*, 1913. Oct. 15. Vol. 16. No. 20, pp. 320–322. With 1 map.

(116) FISKE (W. F.). The Bionomics of Glossina: a Review with Hypothetical Conclusions.—*Bull. Entomol. Research*, 1913. Sept. Vol. 4. Part 2, pp. 95–111.

Biting Insects—*cont.*

Mosquitoes.

(117) THEOBALD (F. V.). New Culicidae from the Sudan.—[*Mucidus nigerrimus*, nov. sp., *Chrysoconops nocturnus*, nov. sp., *Reedomyia sudanensis*, nov. sp., *Kingia maculoabdominalis*, nov., sp., *Aedimorphus quinquepunctata*, nov. sp., *Culicelsa centropunctata*, nov. sp., and *Heptaphlebomyia kingii*, nov. sp.]—*Ann. Trop. Med. and Parasit.*, 1913. Dec. Vol. 7. No. 4, pp. 591–602.

Ticks.

(118) ROBINSON (L. E.) & DAVIDSON (J.). The Anatomy of *Argas persicus* (Oken, 1818). Part II.—*Parasitology*, 1913. Oct. Vol. 6. No. 3, pp. 217–256. With 4 plates and 8 text figs. (For Reference to Part I see Ref. 584, Vol. 1 this *Bulletin*.)

Protozoa.

(119) O'FARRELL (W. R.). Hereditary Infection, with special reference to its Occurrence in *Hyalomma aegyptium* infected with *Crithidia hyalommae*.—*Ann. Trop. Med. and Parasit.*, 1913. Dec. Vol. 7. No. 4, pp. 545–562. With 3 plates.

(120) RATZ (S. von). Trichomonas aus der Leber der Tauben. [Trichomonas in the Liver of the Pigeon.]—*Centralbl. f. Bakt.* 1. Abt. Orig., 1913. Oct. 4. Vol. 71. No. 2 3, pp. 184–189.

(121) WENYON (C. M.). Observations on *Herpetomonas muscae domesticae* and some Allied Flagellates. With Special Reference to the Structure of their Nuclei.—*Arch. f. Protist.*, 1913. Sept. 25, pp. 1–36. With 3 plates, 6 text figs. and 1 diagram.

Unclassed.

(122) COMINOTTI (L.). L'Anemia infettiva del Cavallo. [Equine Infectious Anaemia.]—*Clinica Veterinaria*, 1913. Nov. 30. Vol. 36. No. 22, pp. 983–996.

(123) ELLIS (A. W. M.) & SWIFT (A. F.). The Effect of Intraspinous Injections of Salvarsan and Neosalvarsan in Monkeys.—*Jl. Experim. Med.*, 1913. Oct. Vol. 18. No. 4, pp. 428–434.

(124) KNUTH. Weitere Beobachtungen über *Haemaphysalis punctata* als wahrscheinlichen Ueberträger des Erregers der inneren Verblutung (Milzruptur) beim Rinde. [Further Observations regarding *Haemaphysalis punctata* as the Probable Transmitting Agent of the Cause of Internal Haemorrhage (Rupture of the Spleen) in Cattle.]—*Berl. Tier. Wochenschr.*, 1913. Nov. 20 and 27. Vol. 29. Nos. 47, 48, pp. 832–833 and 853–854.

(125) LEWIS (J. C.). Veterinary and Stock Report and some of the Diseases in Stock in the Northern Territory.—*Bull. of the Northern Territory*, 1913. July. No. 8, pp. 35. With 18 plates.

(126) MITRA (Satyendra Nath). On a Peculiar Form of Pasteurella in an Indian Elephant.—*Centralbl. f. Bakt.* 1. Abt. Orig., 1914. Feb. 11. Vol. 73. No. 1, pp. 12–13. With 1 text fig.

(127) MONTFALLET (D.). Contribution à l'Étude des Maladies du Sang du Bétail de Chile, 1913. Imprimerie Franco-Chilienne, Rue Villa Vicencio 315, Santiago de Chile. pp. 1–23.

TROPICAL DISEASES BUREAU.

TROPICAL VETERINARY BULLETIN.

VOL. 2.] 1914. [No. 2.

BABESIASIS (PIROPLASMOSIS), NUTTALLIASIS, AND ANAPLASMOSIS.

(128) CARPANO (M.). **Kultur der Pferdepiroplasmen und Betrachtung über die Natur der Anaplasmen.** [The Cultivation of the Piroplasms of the Horse and Views regarding the Nature of Anaplasms.]—*Centralbl. f. Bakt.* 1. Abt., Orig. 1914. Feb. 11. Vol. 73. No. 1. pp. 42-53. With 1 plate.

The following is the method employed for the cultivation of both *Nuttallia equi* and *Piroplasma caballi.*

Tubes are prepared containing 1 cc. of distilled water in which sodium chloride and sodium citrate have been dissolved, each in the proportion of 7 per cent. To these are added 9 cc. of fresh defibrinated blood containing the parasites. The tubes are incubated at 25° C.

The author has not been able to get undoubted multiplication of the parasite in the case of *Babesia caballi.* After 48 hours incubation numbers of the pear-shaped parasites are extracellular. Certain changes are to be observed in their chromatin. In some of the parasites the chromatin forms a small round compact mass, while in others it has a loose texture.

By the fifth to the eighth day regular and irregular star-shaped parasites may be seen. The rays of the stars are formed either of cytoplasm alone or partly of chromatin. At the same time there make their appearance large rounded elements, which are composed for the most part of faintly-stained cytoplasm. From the 10th to 15th day large irregular parasites possessing two pieces of chromatin can be found. One of the chromatin masses is large and usually round, the other is small and frequently thread-like.

Subsequently no further development takes place and after a variable length of time the parasites degenerate, the medium at the same time becoming completely haemolysed.

The author considers that these forms must represent sexual forms.

In cultures *Nuttallia equi* does not retain its vitality so long as *B. caballi,* but certain morphological changes and definite multiplication can be observed.

During the first 48 hours the large and medium-sized parasites which are present in the circulating blood almost entirely disappear, and cross-forms are very seldom seen. The bulk of the parasites

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are small and are composed for the most part of chromatin, and indeed some appear to be composed of chromatin entirely.

The process of multiplication is one of direct division in which the chromatin first divides and subsequently the cytoplasm. Corpuscles containing 1, 2, 3, or 4 parasites may be seen. In the latter case they are very small and their arrangement recalls the classical cross-forms. Free forms containing one or two chromatin masses are not infrequently found.

By the 3rd or 4th day the parasites appear to have become even smaller, and shew a tendency to arrange themselves at the periphery of the red corpuscles.

About the 6th to 8th day very small rings and bacillary forms are to be found, and about the same time forms occur possessing the morphological features of anaplasms, but in some of these a rim of cytoplasm can be detected. Parasites which have undergone division either escape from the red cells or are set free from them by their disruption, and would appear from stained preparations to enter fresh ones.

Free forms of the parasite are motile.

By the 20th to 30th day practically all the parasites present the morphological characters of anaplasms, and by this time haemolysis is almost complete.

The author had only one doubtful success in his attempts to transfer the cultures to fresh tubes.

The author has found the anaplasm-like parasites in horses suffering from and recovering from nuttalliasis, and he has also seen cases in which only the anaplasm forms were to be found.

In the portion of the paper dealing with the nature of anaplasms the author summarises at some length the views expressed by various authors, and concludes that anaplasms cannot be considered as absolutely unconnected with the life-cycles of piroplasms.

(129) Carpano (M.). **Piroplasmosis equina.**—*Centralbl. f. Bakt.* 1. Abt., Orig. 1914. Feb. 11. Vol. 73. No. 1. pp. 13-40. With 3 plates and 6 text-curves.

In this paper the author describes in some detail his observations regarding the occurrence of two types of parasite in equine piroplasmosis in Italy. His description of the morphology of the organisms and their methods of multiplication closely agrees with that given by Nuttall and Strickland in 1912.

The author believes that *R. bursa* and *B. annulatus* are the transmitting ticks under natural circumstances, but has apparently been unable to furnish experimental evidence of this.

The clinical, pathological, and epizootiological characters of the two conditions are dealt with at some length.

The author's conclusions are as follows :

1. Equine piroplasmosis may be caused by two distinct parasites, one of which is of comparatively small size. This parasite is characterised by a special method of multiplication which results in the formation of four parasites arranged in the form of a cross. The name *Nuttallia equi* has been given to this parasite. The other parasite is of larger size, and occurs in the form of twin pear-shaped bodies. This parasite multiplies

in the circulating blood by a process of true budding. This organism is known as *Babesia caballi.*

2. The two parasites have a wide distribution, especially in the Old World. *Nuttallia* appears to have a wider distribution than *Babesia caballi.*

Both forms occur in Italy, and, of the two, *Nuttallia* has a wider distribution. Only *Babesia caballi* has been observed up to the present in Eritrea.

3. In Italy a large proportion of the native horses possess a certain degree of immunity, which appears to be partly natural and partly acquired. Imported horses are very susceptible.

4. There are no very marked distinguishing features between the clinical and pathological features presented by the diseases caused by the two types of parasite. There are certain characters of an epizootiological nature which are special to the two diseases.

5. Under natural conditions the diseases are transmitted by *Rhipicephalus bursa* and *Boophilus annulatus,* the latter being responsible for the transmission of *Babesia caballi.*

The diseases are transmissible by blood inoculation, and in cases where failure results this is due to immunity of the animals used.

6. When an animal has recovered from one of the forms of the disease it remains immune to it for a variable length of time. Owing to this fact it has been possible to separate the two types of parasite. An animal that is immune to *Nuttallia equi* can be infected with *Babesia caballi* and vice versa.

(130) SCHELLHASE (W.). **Ein Beitrag zur Kenntnis der Piroplasmosis der Schafe und Esel. Therapeutische Versuche mit Trypanblau. Ueber die Anaplasmosis der Esel.** [Piroplasmosis of the Sheep and Donkey. Therapeutic Experiments with Trypanblue. Anaplasmosis of the Donkey.]—*Zeitschr. f. Infektionskrankh. parasit. Krankh. u. Hyg. d. Haust.* 1914. Feb. Vol. 15. No. 1. pp. 93-97.

The experiments recorded in this paper were carried out with the object of investigating the course of the disease in cases of acute piroplasmosis, the susceptibility of the goat to the piroplasm of the sheep, and the effect produced by trypanblue, if any, upon the course of the disease in the acute stages.

Two young and clinically healthy goats and sheep were inoculated subcutaneously with 20 cc. of defibrinated blood from a sheep infected with piroplasmosis. Parasites were comparatively numerous in the blood.

A few anaplasms were found in the blood of one of the goats before inoculation but no piroplasms. The details of the experiments are a little difficult to follow as the results of daily examinations of the blood are not given.

Apparently anaplasms were first observed in the blood of goat 1 on the 8th day, and piroplasms three days later.

The blood of goat 2 which contained anaplasms at the time of inoculation, was found to be negative on the following day and on the 6th day after inoculation. On the 9th day anaplasms again appeared, to disappear the following day.

Sheep 1 had piroplasms in its blood on the 1st, 9th, 10th and 14th days after inoculation.

Sheep 2. Piroplasms were found on the 8th day and again on the 14th day.

The temperatures of the animals ranged from 38·5° to 41·3° C.

The author concludes from these experiments that piroplasms and anaplasms may be present in the blood of clinically healthy sheep, and suggests the probability that the majority of sheep and goats contract piroplasmosis and anaplasmosis during early life, and either recover or die. It is due to this fact that the experiments had doubtful results.

Piroplasmosis of the donkey.—Up to the present occasional cases only of piroplasmosis of the donkey have been discovered in German East Africa. The author has recently encountered two actual outbreaks of the disease. In one instance 4 out of 11 animals were found to be affected, and in another 10 out of 14. About 25 out of 75 donkeys died during the rains (principally foals) and five mares aborted. In the donkey the disease generally takes a chronic course. The piroplasms are rather longer than *Piroplasma mutans*, and the chromatin is relatively large in amount; "ring," "note," "pear-shaped," and "match-like forms" occur. Parasites are generally scanty in the blood.

Effects of trypanblue.—Five emaciated donkeys were given 40 to 100 cc. of 2 per cent. trypanblue intravenously, but no curative effects were produced.

Anaplasmosis of the donkey.—In the blood of two of the animals treated with trypanblue bodies resembling anaplasms were found, in addition to the piroplasms. On a number of occasions the appearance presented by the bodies suggested multiplication.

TRYPANOSOMIASIS.

(131) Leese (A. S.). **Preliminary Report on Military Camels in Jubaland.**—Manuscript Report forwarded from the Colonial Office on April 23rd, 1914.

The author was detailed to proceed to Kismayu, Gobwen, and Serenli, to investigate the causes of mortality and unthriftiness in camels.

At Gobwen, where the author spent six days, there were 30 riding-camels of the Camel Corps, and of these at least 30 per cent. were affected with trypanosomiasis, clinically indistinguishable from surra. Advice was given regarding the suitability of certain grazing grounds and the diet of the animals. At Serenli, where there were 80 camels, only 10 were found to be affected with trypanosomiasis. Owing to continual movement it was impossible to trace the source of infection, but three of the infected animals were remounts only just arrived from Gobwen.

The principal causes of the mortality, amounting to 35 per cent. per annum, were the unfavourable conditions to which the animals were subjected on arrival in Jubaland, resulting in loss of condition, exhaustion, and death due to pneumonia, lung-abscess, and enteritis.

The unfavourable conditions were:

1. Putting animals to hard work when not in fit condition.
2. Working immature animals.
3. Particularly active patrol work, rendering it impossible to study the needs of the camels in so full a manner as under ordinary conditions.

4. Apathy on the part of the men regarding their animals.
5. Working camels hard through the hot season.
6. The feeding on an insufficient quantity of uncrushed grain, badly infested with weevils.
7. Absence of veterinary advice and suitable food for sick animals.
8. The frequency of sore backs.

Most of the animals were in very poor condition and there were many cases of necrosis of the skin, a disease termed "Gub" (or in India "Joolak"). In most cases the poor condition was not due to disease.

The cases of trypanosomiasis were isolated; one which had also a lung abscess was destroyed. Nine of the animals were rested for four months and then used for safari. Eleven of the total number of animals were $5\frac{1}{2}$ years old or under, and these were kept from hard work until the second pair of permanent incisors were cut (rising 6 years old).

Fly surveys were made from Selagli to Lalashid and Gaba-hari (the northernmost outposts), over routes most frequently used, and warnings against certain camps and grazing grounds given.

Recommendations regarding the management of riding-camels.—

Arab camels require about 5 months to become acclimatised, and should be bought at about 5 years old, so that they may become acclimatised to the country and feeding in the East African Protectorate and be ready for work at rising 6 years old.

The corn ration should be 8 pounds when the animals are at work or grazing between safaris. Millet and grain are the best, particularly the former, as it can be obtained locally. If sim-sim cake, cottonseed, or maize are used, these should not form more than $\frac{3}{8}$ of the ration. All grain should be crushed. If given uncrushed, millet and grain should be first soaked. In the absence of salt-bush, $\frac{3}{4}$ ounce of crushed rock-salt should be given when not on safari. The salt should be given every third or fourth day (i.e. $2\frac{1}{4}$ to 3 ounces), on watering day, first thing in the morning.

No marching should be done between 10.30 and 3 o'clock in the cool season, and these hours should be earlier and later respectively in the hot season. The average daily distance for fit riding-camels on safari is about 20 miles. A good rest should be given before the next safari.

Camels should be trained to go for four days without water in the dry season.

Saddles should be so constructed as to prevent pressure on the spine. This pressure is the most frequent cause of sore backs. Among 200 transport camels at Serenli 64 cases of trypanosomiasis had been discovered up to date, and this is the principal cause of death. Grain is not necessary for transport camels if they are properly cared for and are not unduly pushed. The distance covered daily on safari should not exceed 15 miles, and a rest should be given before the next safari is undertaken. The marches should be averaged, provided water supplies permit.

For working Somali camels not getting grain, watering in the dry season should be every three days.

Well-grown camels can carry 300 pounds if well cared for and under proper conditions on safari.

Marching by rivers should be avoided whenever possible, especially during rains and for four or five weeks after. When it is necessary, the less valuable camels should be used, and marching should be carried out at night, the animals grazing in the desert.

It is probably only below Selagli that travelling by river route is dangerous at all times.

A report on trypanosomiasis, the distribution of biting flies, and on other infective diseases and preventive measures will follow later.

(132) YAKIMOFF (W. L.) & SCHOKHOR (N. I.). **Recherches sur les Maladies tropicales Humaines et Animales au Turkestan. (3) Les Trypanosomiases des Chameaux et des Anes au Turkestan.** [Investigations regarding Human and Animal Tropical Diseases in Turkestan. (3) The Trypanosomiases of the Camel and the Ass in Turkestan.]—*Bull. Soc. Path. Exot.* 1914. Mar. Vol. 7. No. 3. pp. 187-188.

The authors have examined 476 camels, and have found 22 infected, but they state that this figure is probably too low, as camels may be infected without the parasite being discoverable in the peripheral blood.

The parasite was in all cases transmissible to guinea-pigs, and is said to be of the surra-nagana type. The possibility is suggested that it is in reality the trypanosome of Indian surra. They have never observed trypanosomes in the peripheral blood of mules and donkeys in Turkestan, but they state that at Bukhara they took from 1 to 3 drops of blood from 216 donkeys, diluted it with physiological serum and inoculated a guinea-pig subcutaneously. The animal became infected, the trypanosome being of the same type as that found in the camels.

(133) LAVERAN (A.). **L'Agent du Debab d'Algérie est le *Trypanosoma soudanense* (Laveran).** [The Causal Agent of Debab is *Trypanosoma soudanense.*]—*Compt. Rend. Acad. Sci.* 1914. Jan. 12. Vol. 158. p. 93.

The author has carried out a fresh series of experiments shewing that Debab is caused by *T. soudanense*, a trypanosome originally obtained from the Upper Niger.

Cross immunity experiments have been carried out. The strains used were the original *soudanense* strain sent to France in 1906 by CAZALBOU and since kept running in guinea-pigs, and the debab virus obtained from a dromedary from the Touggourt-Biskra district.

The animals employed were: A goat having a high degree of immunity to *T. soudanense*, a control goat, and a goat immune to surra, which according to certain observers is allied to debab.

The experiments had the following results:—

The goat possessing immunity for *T. soudanense* resisted infection with the trypanosome that is responsible for debab, while the control goat and that immune to surra became infected. In a previous publication the author shewed that cattle immune to debab resisted infection with *T. soudanense*, and in the present note evidence is furnished that a goat immune to *T. soudanense* resists infection with

debab. The demonstration of the identity of the viruses is therefore complete.

The strain of *T. soudanense* in the possession of the author is slightly more active than the Algerian strain of the debab virus, and this explains why some animals immune to the latter became infected by the former.

In order to avoid this source of error in carrying out cross immunity experiments for the identification of two viruses, the immunity towards each must be tested by the other.

(134) Blacklock (B.) & Yorke (W.). **The Probable Identity of *Trypanosoma congolense* (Broden) and *T. nanum* (Laveran.)**—*Ann. Trop. Med. & Parasit.* 1913. Dec. 30. Vol. 7. No. 4. pp. 603-607.

In a previous paper (see this *Bulletin* Vol. 1, p. 76) a description was given of two parasites found in the blood of a horse imported from the Gambia. These parasites were separated accidentally. One was certainly *T. vivax*, but regarding the identity of the other there was some doubt.

The authors succeeded in infecting small animals with this trypanosome and finally decided that it was *T. dimorphon* (*T. congolense*). They have been able to maintain this parasite in rats. The subinoculations made from the time of isolation up to the 57th generation are shewn in a table, and from this the following information may be gathered.

1. Most of the early inoculations failed, while subsequently they were invariably successful.

2. The course of the disease in the earlier generations was chronic, and in the later ones acute. The average length of life of the rats from the 5th generation (when the strain was firmly established in the rat) to the 14th, was 88·6 days, but the average duration of life of the rats in the 42nd to 51st generations was only 8·6 days.

This appears to the authors to have some significance in connection with the nomenclature of the parasite. *T. congolense* and *T. nanum* are morphologically identical. They are spread by the same species of fly, and flies are infected in the same manner by each parasite. Had only a small number of experimental animals been available, as is usually the case in the tropics, the trypanosome would probably have been identified as *T. nanum*. Weissenborn described a short aflagellar trypanosome of equines in Togoland in 1911 and stated that it was of inconstant virulence.

The Sleeping Sickness Commission of the Royal Society state that *T. pecorum* loses its pathogenicity for other animals by passage through goats, thus giving rise to the erroneous idea that a separate species, *T. nanum*, exists.

The Belgian Sleeping Sickness Commission have found that aflagellar trypanosomes occurring in dogs are not always pathogenic for the rat and guinea-pig.

The authors can therefore find no evidence warranting a distinction being made between the morphologically identical parasites *T. congolense* and *T. nanum*, on the grounds of pathogenicity.

(135) TRAUTMANN (R.). **Inoculation Positive de *Trypanosoma cazalboui* à un *Cercopithecus patas*.** [Successful Inoculation of a *Cercopithecus patas* with *Trypanosoma cazalboui*.]—*Bull. Soc. Path. Exot.* 1914. Feb. Vol. 7. No. 2. pp. 118-121.

With the exception of a few cases of transient infection in rats and guinea-pigs, *T. cazalboui* is as a rule transmissible to ruminants and equidae only. A *Cercopithecus patas* was inoculated subcutaneously with 5 cc. of blood containing large numbers of trypanosomes from a calf which was on the point of death.

On the third day there was distinct autoagglutination of the red corpuscles. Trypanosomes appeared in the blood in very small numbers on the 6th day. On the 9th day, when no trypanosomes could be found in the blood, a sheep, a native dog, a young guinea-pig, a cynocephalus monkey, two grey rats, and a rabbit were inoculated from it. Trypanosomes were not seen again until the 11th day. On this day the monkey died.

At the post-mortem, all the glands, the liver, spleen, and kidneys were found to be enlarged.

The blood shewed a few degenerating trypanosomes, but none were found in one of the mesenteric glands.

The dog, guinea-pig, cynocephalus monkey, and rabbit failed to become infected. The rats never shewed trypanosomes in their blood, but they died on the 12th and 18th days. The sheep became infected and trypanosomes were found on the 8th day. Two patas, a rabbit, and a guinea-pig inoculated from the sheep failed to become infected, but a kid died on the 20th day. The trypanosome was identified by MESNIL.

(136) DELANOË (P.). **Des Variations du Pouvoir Infectieux et de la Virulence du *Trypanosoma dimorphon*, à partir d'Infections Naturelles présentées par les Boeufs et les Moutons. Note préliminaire.** [Variations in the Pathogenicity and Virulence of *T. dimorphon* derived from Natural Cases in the Ox and Sheep.] —*Bull. Soc. Path. Exot.* 1914. Jan. Vol. 7. No. 1. pp. 58-63.

During a period of rather less than 6 months the author has examined some 3000 cattle and sheep for trypanosomiasis. The examinations were made in the course of the inspection of animals passing down from Upper Senegal and the Niger to the coast. For the detection of trypanosomes a single examination of moist blood was made, the animals which were declared free from infection upon the result of this examination being allowed to proceed. The only trypanosomes encountered were *T. cazalboui*, *T. dimorphon*, and *T. pecaudi*. The latter was found in a few instances only.

A series of 7 sets of experiments were carried out with *T. dimorphon*. In five instances the trypanosome (derived from 3 oxen and 2 sheep) was not inoculable directly to either the rat or the guinea-pig. In one case the trypanosome was transmitted directly to the rat, but not to the guinea-pig, and in the remaining case it was inoculable to both the rat and the guinea-pig.

Details are given of the experiments, and from these it appears that rats and guinea-pigs may possess complete immunity against

T. dimorphon, repeated intraperitoneal inoculations with small quantities of virulent blood, and single intraperitoneal or intravenous inoculations with large quantities failing to break the immunity down.

In the instance in which the rat became infected while the guinea-pig proved refractory, the infection in the rat was a very slight one. Trypanosomes were found in its blood in very small numbers on the 21st and 81st days only.

The last series of experiments shewed that the trypanosome is capable of setting up a rapidly fatal infection in both the rat and the guinea-pig. In this instance two white rats and one out of the two guinea-pigs inoculated from the infected ox shewed a mixed infection of *T. dimorphon* and *T. pecaudi*, and died. A goat, whose blood had failed to cause any infection when inoculated into a rat, was inoculated from the ox, and contracted the dimorphon infection only. From this goat five field rats and two guinea-pigs were inoculated with fatal results.

The author does not think that there are any specific differences between the trypanosomes without free flagellum which are directly inoculable to rodents and those that are not. There is no essential morphological difference.

In a future paper the author proposes to shew that he has been able to inoculate rats with the virus against which rats possessed a complete immunity at the first inoculation.

The author believes that there are several strains of *T. dimorphon* which differ from each other only in the varying susceptibility possessed by animals towards them.

(137) Laveran (A.) & Marullaz (M.). **Essais d'Immunisation contre le Nagana Expérimental des Souris.** [Attempts to immunise Mice against Experimental Nagana.]—*Bull. Soc. Path. Exot.* 1914. Jan. Vol. 7. No. 1. pp. 53-58.

The experiments of Rondoni and Goretti have been repeated using trypanosomes subjected to salvarsan in very dilute solutions as the immunising agent. The strain used was the "ferox" strain (Ehrlich).

In all, eight experiments were made, and six mice were used in each. The full details of four of the experiments are given and the remainder are summarised. The trypanosomes were obtained by centrifuging blood containing large numbers after the addition of citrated broth, and recentrifuging. The trypanosomes so obtained were mixed with the salvarsan solutions varying in strength from 1 in 1,000 to 1 in 40,000. These were left for half an hour at room temperature, centrifuged, washed with salt solution, and injected.

The results obtained differed in a marked degree from those of Rondoni and Goretti. Whereas the latter authors obtained an absolute immunity in 40 to 50 per cent. of animals, Laveran and Marullaz have not obtained a permanent immunity in any instance.

In 30 instances a more or less rapid infection followed the immunisation. Of 18 cases in which vaccination did not cause infection, 16 became infected when tested, and two which resisted a first infection became infected when a second dose of active virus was administered.

A slowing of the movements of the trypanosomes in the salvarsan solutions is not a sufficient guide as to the effects of the salvarsan. Dilutions of 1 in 10,000 to 1 in 5,000 simply increased the period of incubation, and dilutions of 1 in 1,000 and 1 in 2,000 yielded the same results as dead trypanosomes, i.e. failed to produce either infection or immunity.

(138) JOHNS (F. M.). *Trypanosoma americanum.—New Orleans Med. & Surg. Jl.* 1914. Jan. Vol. 66. No. 7. pp. 533-534.

While working upon the cultivation of *B. bigeminum* the author encountered a very large trypanosome in the blood of a calf, and subsequently found 43 adult animals and 2 yearlings to be infected, by direct examination.

It was found possible to cultivate the trypanosome by adding half the volume of 1 per cent. dextrose to defibrinated cow's blood and incubating at any temperature from 27° to 40° C. It was found that the addition of serum containing complement to the cultures after the first 24 hours destroyed them. The author concludes from this that if an insect transmitter feeds again before the trypanosomes contained in the infective feed reach the hind gut, the insect becomes non-infective.

(139) DELANOË (P.). **Le Fonctionnement du Service de Prophylaxie à Bouaké (Côte d'Ivoire) à l'Egard des Trypanosomiases Animales du 10 Juin au 31 Déc. 1913.** [The Working of the Prophylactic Measures against Animal Trypanosomiases at Bouaké (Ivory Coast) from 10th June to 31st December, 1913.]—*Bull. Soc. Path. Exot.* 1914. Feb. Vol. 7. No. 2. pp. 152-160. With 1 map.

The new sanitary measures involve the systematic examination of the blood of animals passing through Bouaké. The rule adopted is, that only those animals in which trypanosomes cannot be found at a single examination are allowed to go to the coast. Affected animals are kept under observation at Bouaké, or if sufficiently fat are slaughtered.

Only three or four horses have been examined, the remaining animals being cattle and sheep coming for the most part from Upper Senegal and the Niger. Out of 4,086 animals (2,115 cattle, 1,971 sheep) only 214 came from the Ivory Coast. Bouaké is the centre of the cattle traffic, the herds from the Soudan being brought there by middlemen for transmission to the coast and other parts.

The animals are inspected before they are sold and are branded in a manner indicating whether they have passed the examination or not, so that the loss rests principally on those bringing the animals to Bouaké. Infected animals that are in sufficiently good condition to be slaughtered and consumed locally fetch considerably lower prices than those that are passed.

Animals may be rejected on account of emaciation alone, and to save time the blood of these is not subjected to examination.

Emaciated animals may have no trypanosomes in their blood and in

the blood of fat animals they may be numerous. This is explained by the fact that the number of trypanosomes present in the blood at different stages of infection varies. The meat from well-nourished infected animals does not differ in any way from that of healthy animals.

Twenty-one per cent. of the cattle were found to be infected, and 4·6 per cent. were condemned for emaciation.

Of the sheep 10·4 per cent. were condemned for trypanosomiasis and 0·8 per cent. for emaciation.

A table is given shewing the number of cattle and sheep examined each month during the period under review. The increase in the number of animals inspected during December as compared with the previous months indicates that the inspection has not hindered trade.

Of the three types of Soudan cattle (the Zebu or large humped animals, the small animals without humps, and the cattle with small humps), the first are most frequently found to be infected and they do not bear long journeys well.

The animals that are infected to the smallest extent, and are less frequently emaciated, are those from Lobi. The herds having the highest percentage of diseased and emaciated animals were those from Macina, where souma occurs in a very virulent form.

The only trypanosomes encountered were the *T. cazalboui*, *T. dimorphon* and the *T. pecaudi*, in order of their frequency.

The author states that confirmation can be furnished of the part played by Stomoxys in the transmission of souma. The inspection has been criticised as hindering trade, but the author states that apart from any consideration of prophylaxis the inspection has lead to an improvement in the quality of the animals.

(140) Mesnil (F.) & Blanchard (M.). **Sur l'Identification du Virus d'un Cas de Trypanosomiase Humaine contractée au Laboratoire.** [The Identification of the Virus in a Case of Human Trypanosomiasis contracted in the Laboratory.]—*Bull. Soc. Path. Exot.* 1914. Mar. Vol. 7. No. 3. pp. 196-200.

The case referred to in this paper is that of Professor Lanfranchi of Parma.

It is said that only two strains of trypanosomes, namely, nagana and surra, had ever been kept at the University of Parma.

A strain of the trypanosome which was thought to be the cause of Lanfranchi's infection was obtained from Parma, and animals were inoculated from Lanfranchi himself.

A number of investigations were carried out with these trypanosomes and the sera from infected animals, and the general results indicated that the animal strain received from Parma and that isolated from Lanfranchi were quite distinct.

Cross immunity tests and the actions of protective sera indicated that the strain derived from Lanfranchi did not differ from *T. gambiense*, and that the animal strain derived from Parma was *T. evansi*.

The authors are not prepared to state definitely that the strain from the human source was actually *T. gambiense*.

(141) Roubaud (E.) & Lafont (A.). **Expériences de Transmission des Trypanosomes Humains d'Afrique par les Moustiques des Habitations** (*Stegomyia fasciata*). [Experiments regarding the Transmission of the Human Trypanosomes in Africa by Mosquitoes (*Stegomyia fasciata*).]—*Bull. Soc. Path. Exot.* 1914. Jan. Vol. 7. No. 1. pp. 49-52.

The authors have used *T. gambiense* and *T. rhodesiense*, and monkeys, guinea-pigs, and rats were employed. It was found that transmission occurred in those cases only in which the mosquitoes were immediately transferred to susceptible animals from infected animals which had numerous trypanosomes in their blood. The authors point out, however, that the experiments are not strictly comparable with infection of man because of the hair covering the animals' bodies, this rendering it difficult for the mosquitoes to bite. The experiments also shewed that the virus does not remain active in the mosquito for more than 24 hours.

(142) Prentice (G.). **Sleeping Sickness, Tsetse, and Big Game.**—*Brit. Med. Jl.* 1914. Feb. 7. pp. 293-294.

This paper contains a general summary of the author's experiences in connection with game and tsetse fly in Nyasaland and Rhodesia, where, save for three periods of furlough, he has worked since 1894.

He speaks with personal experience of large tracts of country where not a single fly was encountered years ago, and where now they abound. He attributes the spread of the fly to the increase in the number of game animals, and this in turn is attributed to the protective measures put into force by the Government. The lives of men and domesticated animals are being lost as a result of this spread of the fly.

The author advocates a general onslaught on wild animals as offering the best chance of eradicating trypanosomiases. He does not believe that the destruction of the game would lead to the fly attacking man and domesticated animals, and expresses the opinion that with the destruction of the game the fly would disappear.

(143) Weck. **Beobachtungen über Trypanosomen des Menschen und der Tiere am Rovuma-Flusse.** [Observations on the Trypanosomes of Man and Animals on the Rovuma River.]—*Arch. f. Schiffs- u. Trop.-Hyg.* 1914. Feb. Vol. 18. No. 4. pp. 113-124.

The question of the identity of the trypanosomes occurring along the Rovuma is of practical importance on account of the fact that *Glossina palpalis* does not occur along the course of the Rovuma from Mitomoni to Sasawara, but only *G. morsitans*. Although the latter fly has a wide distribution in German East Africa it appears up to the present to have been a source of danger to domesticated and wild animals only, no case of trypanosomiasis having been observed in man.

The trypanosome found along the Rovuma is said to be morphologically and biologically distinct from *T. gambiense*, and, according to Taute, identical with *T. rhodesiense*.

The view expressed by Bruce that *T. rhodesiense* is identical with *T. brucei* is questioned, and it is said that while nagana is of common occurrence in wild and domesticated animals in the *Glossina morsitans*

district, cases of trypanosomiasis in man have not been observed. It should be noted that the diagnosis of nagana is based in the great majority of cases upon microscopic examination. The explanation of the absence of trypanosomiasis in man is possibly that *T. rhodesiense* requires certain climatical conditions, and, particularly, higher temperatures. There are however many areas in the colony with the same climatic and geographical condition where game is plentiful and *Glossina morsitans* occurs in large numbers, but in which trypanosomiasis has not been observed in man.

The possibility is not excluded that the trypanosome recognised as *T. brucei* in German East Africa is not the same as that occurring in Nyasaland and Rhodesia, and when diagnosis is based upon microscopic examination it is quite possible to confuse trypanosomes.

A number of species of wild and domestic animals have been found to be infected with trypanosomes by direct microscopic examination in the Mitomoni, Sasawara, and Lumesule Districts, and a number of positive experimental infections have been obtained.

Positive results were obtained in every case when monkeys were inoculated with blood containing the trypanosome occurring in man, no matter from what species of animal the infective material was obtained. In some cases an exaltation of virulence was observed when the trypanosome was carried on from one animal to another of the same species. Strains of trypanosomes which are not transmissible to the monkey are probably not identical with the human strain. The identity of the trypanosomes has been established by inoculation into various species of experimental animals, microscopic examination of living and stained specimens, and serum methods of diagnosis.

The author has found the human trypanosome to be inoculable for the monkey, dog, cat, rat, mouse, "huko" (a mole-like animal), guinea-pig, young leopard, and ngolombwe (a small antelope). With the exception of the last-named, all the infected animals died within a month. Only one strain of trypanosomes, found in a water-buck, was infective for the same experimental animals as the human strain. This was dimorphic, and intermediate forms were found. The long forms of the antelope strain were more active than the corresponding forms of the human strain, the movement appearing to be of one rapid vibration rather than a writhing one. In either case the movement involved little translation. In stained preparations marked displacement of the nucleus was observed in both strains. In the trypanosome found in the antelope the centrosome was frequently absent, but this was not observed in the human strain.

Cross immunity tests could not be carried out, but the activity of the serum was tested by LAVERAN and MESNIL'S method in a number of cases, and certain biological differences were found between the two strains. It may therefore be concluded that the two are not absolutely identical.

The trypanosomes found in a ngolombwe failed to infect a monkey, but infected a rat. Inoculation of further rats from this one failed; the trypanosome therefore could not be *T. rhodesiense*. The antelope was inoculated with blood from an infected man containing numerous trypanosomes. The trypanosomes previously present in the blood did not increase in numbers. Two monkeys and a dog were then inoculated from the antelope and infection took place.

The author therefore concludes that the human trypanosome was present in the antelope's blood.

The author's conclusions may be summarised as follows:

The trypanosomes found in game in the neighbourhood of Sasawara resemble those found in man, but present certain morphological and biological differences which make it impossible to consider the two as identical.

The human parasite can be experimentally transmitted to game, and from this it may be concluded that the transmission occurs in nature through the medium of tsetse flies.

Killing off the game as a means of combating the disease must be avoided, as it would have the effect of driving animals having a slight infection into clean districts where the conditions are suitable for *T. rhodesiense*, and lead to the infection of flies, man, and animals. If the game is to be killed off, the extermination would have to be complete, a measure which is in the author's opinion impracticable.

Human beings must be considered as the most important carriers of infection. The disease was probably brought in from Portuguese territory by natives, and medical examination must therefore be established in order to detect the disease in natives entering the colony.

(144) Beck (M.). **Untersuchungen über ein am Rovuma (Deutschostafrika) vorkommendes Trypanosoma beim Menschen.** [Investigations on a Trypanosome occurring in Man in the Rovuma District, German East Africa.]—*Arch. f. Schiffs- u. Trop.-Hyg.* 1914. Feb. Vol. 18. No. 3. pp. 97-101. With 1 plate.

In 1911 and 1912 a number of small foci of sleeping sickness were discovered along the Rovuma and its tributaries which must have been due to the introduction of the disease from the neighbouring Portuguese territory. Seventy-two cases have been discovered.

The disease appears to be transmitted solely by *G. morsitans*, and 8 to 10 per cent. of the flies were found to be infected with trypanosomes. It was impossible to identify the trypanosomes found in the flies owing to the lack of experimental animals.

Experiments were undertaken to ascertain whether the trypanosome occurring in man was identical with *T. brucei*, as cattle had died of *brucei* infection in the district.

The posterior extremity of the human parasite usually has a loose structure and stains faintly. The anterior end is pointed, the nucleus is round and oval, and it was never observed to lie posterior to the blepharoplast. In a few cases it was close to the blepharoplast, but this is due in the opinion of the author to uneven drying of the cytoplasm. The lack of a micrometer eyepiece rendered it impossible to make any comparative measurements.

A strain of *T. brucei* was obtained from an infected mule, and comparative experimental inoculations with the human and animal strains shewed that the human strain was rather more virulent for the dog, monkey and rat than the animal strain.

In the animals infected with the human strain long forms first appeared in the blood, these were followed by intermediate forms, and then by short thick forms. Irregular rounded forms were observed in the blood of rats inoculated with blood containing the human parasite.

For further differentiation of the parasites, agglutination and agglomeration experiments were carried out. The results given by the former failed to reveal any distinction between the two. Cross-

immunity experiments were also undertaken, and these were successful to the extent that the trypanosomes did not appear in the blood of immunised rats (rats infected and then treated with atoxyl) until from 10 to 15 days after they had appeared in the blood of rats that had not been treated.

A number of animals were examined for trypanosomes in infected districts with the following results:

Of 8 dogs examined 5 were found to be infected. Three goats were all negative. Two water-bucks were positive out of three examined, and one of two elands also contained trypanosomes. A gnu, leopard, a spotted hyena and a number of monkeys and birds were negative.

(145) Duke (H. L.). **Wild Game as a Reservoir for Human Trypanosomes.**—*Brit. Med. Jl.* 1914. Feb. 7. pp. 289-292.

The author points out in the first place the great divergence of opinion held by observers engaged in the biological problems connected with sleeping sickness. The view held by the German investigators is that the game trypanosomes are not pathogenic for man, and that held by British investigators is that certain of the trypanosomes recovered from game are identical with *T. rhodesiense*.

Three years after the native population were moved from the islands and the lake shore of Victoria Nyanza, *G. palpalis* on the lake shore was capable of infecting monkeys with trypanosomes indistinguishable from *T. gambiense*, and an exactly similar trypanosome was recovered from the blood of two situtunga at about the same time or a little earlier. These animals were shot on Damba Island, a few miles from the mainland. The question arises whether the fly and the antelope trypanosomes are the descendants of the *T. gambiense* which was responsible for the epidemic, or are simply parasites of the antelope.

The author sets out his subject in the form of a number of questions and gives the available information upon which answers may be based.

With regard to the identity of the fly and the antelope trypanosomes, the author states that in a previous publication he has shewn that the identity cannot be doubted.

The evidence shews that the trypanosome of the fly is derived from the antelope and not from other sources.

Natives visiting prohibited areas are probably not the source of the infection of the flies and consequently of the antelope.

With regard to the question whether the lake-shore trypanosomes can be identified with *T. gambiense*, the answer is that while there is no good evidence to shew that the fly and the antelope trypanosome are not identical with *T. gambiense*, there is a certain amount of evidence to shew that they are.

Experiments shew that wild antelope of the species frequenting the lake shore are inoculable with the human trypanosome, and further that they are capable of acting as a source of infection for flies for 22 months at least, and probably longer.

The evidence on the subject of the infectivity of the wild fly to the wild-fly trypanosome is not so complete as could be desired, but it rather supports the view that the trypanosome of the wild fly is *T. gambiense* and not an antelope parasite.

There is no trypanosome known in Uganda possessing the animal reactions of the lake shore organism other than *T. gambiense.*

The percentage of antelope harbouring *T. vivax* and *T. uniforme*, that is, trypanosomes non-pathogenic for man, is slightly higher on the Island of Damba than on the mainland, 14·2 as compared with 10, but the natural conditions obtaining in two places are sufficient to account for this. The percentage of wild lake shore flies harbouring these parasites is about 0·1.

The author contends that the available evidence justifies the conclusion that the trypanosome recovered from the Damba situtunga and from the wild *G. palpalis* on the islands and on the coast of the mainland is a descendant of *T. gambiense.*

(146) Cruca (A.). **Action des Abcès de Fixation sur la Trypanosomiase Expérimentale du Cobaye et sur son Traitement par l' Atoxyl.** [The Effect of Fixation-Abscesses upon the Treatment of Experimental Trypanosomiasis in the Guinea-pig and its Treatment with Atoxyl.]—*Ann. Inst. Pasteur.* 1914. Jan. Vol. 28. No. 1. pp. 6-20.

The author refers briefly to the observations of a number of authors regarding the beneficial effects produced by abscess formation in protozoal diseases (malaria, canine babesiasis, and sleeping sickness).

The investigation was undertaken by the author because in the cases referred to the abscess formation was of an accidental nature.

Essence of terebene is one of the chemical substances which is specially used for the production of fixation abscesses. The majority of the experiments have been carried out with the Uganda strain of nagana, as, according to the author, the course of the infection in the guinea-pig with this trypanosome is very constant, trypanosomes persisting in the blood from their first appearance up to the time of death. A further reason for using this trypanosome is that, according to Laveran and Thiroux's experiments, atoxyl alone is unable to effect a cure. In some of the experiments the guinea-pigs were infected with surra.

Ordinary commercial essence of terebene was used and it was injected subcutaneously on the outer side of the thigh, as high up as possible in order to avoid gangrene of the foot, and diffusion of the pus during abscess formation. The injection caused extreme disturbance which lasted for about half an hour. The resulting inflammation reached its maximum about the 72nd hour, abscess formation occurring about the 4th or 5th day. The pus was thick and of a dirty white colour. A strong odour of terebene could be detected even when the abscess was left for 10 days before opening. The susceptibility of the guinea-pig to the terebene varied greatly. In some there was marked loss of condition in 10 days, in others no effect of this kind was observed, and in some guinea-pigs no local inflammation would be produced.

The dose varied from 0·5 to 1 cc.

A freshly prepared solution of atoxyl in sterile distilled water was used, and the dose varied from 1·5 to 2 cc.

The disappearance of the trypanosomes from the circulation was frequently controlled by the inoculation of mice.

Forty-two guinea-pigs infected with Uganda nagana were used.

Eleven of these were controls and the remainder were treated either with terebene alone, or with terebene and atoxyl. Of ten guinea-pigs infected with surra, four were controls and the remainder were treated with terebene only.

The controls infected with the Uganda trypanosomes died in from 11 to 56 days, and those infected with surra in from 17 to 41 days.

Group A.—Guinea-pigs treated solely with essence of terebene.

Series 1. Guinea-pigs receiving one or more injections of terebene, the first being given at the time of infection in order to judge the effect upon the period of incubation.

Series 2. Guinea-pigs receiving a single injection of terebene when the infection was at its maximum.

In both of these series the two species of trypanosome were used.

The conclusions drawn from these experiments may be summarised as follows: The injection of the terebene at the same time as the infective inoculation prolongs the period of incubation by some days in the case of both trypanosomes. The injection of terebene when trypanosomes are most numerous in the blood causes a diminution in the number or, more frequently, a complete disappearance, commencing 24 to 48 hours after the injection. This is followed after an interval of about five days by a relapse. In spite of the severe experimental conditions, especially in the second series, the treated guinea-pigs frequently lived considerably longer than the controls.

Group B.—Guinea-pigs included in this group were inoculated intraperitoneally with the Uganda nagana strain and then treated with atoxyl and essence of terebene.

Series 1. Guinea-pigs receiving two injections of atoxyl and terebene. These were subdivided into two lots.

a. Those that received the first injection of terebene at the time of infection and the first injection of atoxyl when the trypanosomes were very numerous in the blood.

b. Those receiving simultaneous injections of terebene and atoxyl at the height of infection. As controls infected guinea-pigs treated with atoxyl and guinea-pigs which were left untreated were used.

Series 2. Guinea-pigs receiving several injections of terebene and atoxyl.

The dose of terebene used was 1 cc. in every case, and a fresh injection was only given when the abscess caused by one dose burst.

These guinea-pigs were also divided into two lots.

In the first lot the atoxyl injections were given every eight days in two doses of 0·015 and 0·02 g. at an interval of 24 hours. In the second lot the injections were given every five days, irrespective of whether the trypanosomes were present in the blood or not. The treatment was commenced two or three days after the appearance of trypanosomes in the blood. Controls similar to those of the first series were used.

The following is a summary of the conclusions drawn:

1. Atoxyl causes only a temporary disappearance of trypanosomes from the blood of guinea-pigs inoculated with the Uganda strain of nagana.

2. The injection of atoxyl in conjunction with abscess formation resulting from the injection of essence of terebene always produces a disappearance of trypanosomes from the blood which lasts for several days.

3. Repeated application of the combined treatment effects a complete disappearance of trypanosomes which lasts for a long time, but a complete cure is not effected.

4. Guinea-pigs weighing from 400-600 grammes can withstand twelve or thirteen injections, and possibly more, of atoxyl in doses from 0·015 to 0·02 g. More than 1 cc. of terebene must not be given at a dose, and the number of injections possible depends upon the emaciation produced.

The deaths of some of the treated animals before the controls may be ascribed to this.

5. Combined treatment appears to be superior to treatment with atoxyl alone. The terebene or the resulting abscess formation probably facilitates the formation of trypanotoxyl.

6. The method should be tried upon large animals in which abscess-formation does not produce so marked a debilitating effect.

(147) KOLLE (W.), HARTOCH (O.) & SCHÜRMANN (W.). (i) **Weitere Mitteilungen über chemotherapeutische Experimentalstudien bei Trypanosomeninfektionen.** [Further Chemotherapeutic Experiments in Connection with Trypanosome Infections.]—*Deut. Med. Wochenschr.* 1914. Jan. 29. Vol. 40. No. 5. pp. 212-214.

(148) (ii) **Chemotherapeutische Experimentalstudien bei Trypanosomeninfektionen.** ii. **Mitteilung.**—*Zeitschr. f. Immunitätsforsch. u. experim. Therapie.* Orig. 1914. Jan. 22. Vol. 20. No. 5. pp. 436–475.

i. The authors reaffirm their statement published previously, to the effect that compounds of pentavalent antimony are practically useless for the treatment of trypanosomiasis.

Their experiments with Trixidin (antimony trioxide) upon large animals did not yield the satisfactory results obtained with small laboratory animals. Rabbits, dogs, and monkeys were used, and the intramuscular injection of trixidin lead to abscess formation. In a few cases, however, injections into rabbits were not followed by any untoward complications.

With the object of trying to avoid this, a number of substances were added to the trixidin suspension (in oil), but without success. The distribution of the injections over the body also failed to prevent abscess formation.

They succeeded however in administering the drug intravenously in salt solution, and they were able to cure rabbits infected with dourine by one or two injections.

By a special process it was found possible to get the antimony trioxide into a sufficiently fine state of division to permit of its being used for intravenous injection. At the same the drug presented a greater effective surface.

The good results obtained with commercial antimony trioxide are improved upon by the use of the drug in a more finely divided form, but results are not yet ready for publication. An attempt was made to treat horses infected with dourine by means of intramuscular injections, but, as in the case of the rabbits, abscess formation resulted.

OSTERTAG reports to the authors that good results have been obtained with naturally infected cattle in East Africa. Information is not given as to how the treatment has been carried out in this instance. Up to the time of writing (2 months) the treated cattle had remained free from trypanosomes.

Trixidin has been found to be capable of protecting animals against infection for a period of several weeks.

The method of making a salve either with metallic antimony or with insoluble organic compounds has been used successfully. No toxic effects have been produced.

Dimethyl-phenyl-pyrazalon-antimony-trichloride salve and intramuscular injections of trixidin are said to have a marked effect upon sleeping sickness in man, but abscess formation results from the latter treatment. No experiments have as yet been carried out using the intravenous injection method.

Conclusions :—

1. Trixidin effects a cure in the case of large animals affected with chronic trypanosomiasis.

2. In cases in which intramuscular injections of trixidin lead to abscess formation, infected rabbits and guinea-pigs can be cured by intravenous injections—antimony trioxide in salt solution.

3. A lasting cure can be effected in the case of dogs suffering from chronic dourine by the injection of antimony compounds, and particularly of dimethyl-phenyl-pyrazalon-antimony-trichloride (Scheitlin).

4. The principle advocated by us (involving the use of insoluble compounds of antimony or the inunctions) can also be applied to the human subject, but at the moment abscess formation precludes the subcutaneous or intramuscular injection of antimony trioxide.

5. Antimony trioxide can be obtained in a form resembling the colloidal form by a special process, and this can be used with great success for intravenous injection into small animals.

6. Further investigation is required to see whether colloidal antimony trioxide can be used for the treatment of sleeping sickness in man, or as an adjuvant in a combined treatment.

ii. This paper contains a fuller and more detailed account of the above experiments.

(149) Moldovan (J.). **Ueber die Wirkungsart des Atoxyls, Salvarsans und des Menschenserums bei der experimentellen Naganainfektion.** [The Nature of the Action of Atoxyl, Salvarsan, and Human Serum in Experimental Nagana.]—*Zeitschr. f. Immunitätsforsch. u. experim. Therapie.* Orig. 1914. Mar. 14. Vol. 21. No. 1/5. pp. 481-519.

The author's experiments lead him to conclude that atoxyl acts directly upon the trypanosomes, and that the body cells, phagocytes, and other defensive powers of the body do not intervene. The atoxyl is absorbed by the trypanosomes and the toxic substance is formed in their own bodies. The animal body is necessary only in so far as it renders a multiplication of the parasites possible, involves an increase in metabolism, and leads to the absorption of substances and the production of toxic materials. In vitro the parasites are indifferent owing to their low vitality.

The property of being atoxyl-fast appears to depend not only upon absorption not taking place or the atoxyl not being reduced, but also upon the insusceptibility of the trypanosomes to the toxic products. The same holds good for salvarsan and human serum.

(150) Lurz (R.). **Versuche mit dem Trypanosomenheilmittel "Trixidin" bei schlafkranken Menschen.** [Experiments with Trixidin in the Treatment of Sleeping Sickness in Man.]—*Arch. f. Schiffs- u. Trop.-Hyg.* 1914. Mar. Vol. 18. No. 6. pp. 212-213.

Trixidin is a 30 per cent. emulsion of antimony trioxide in oil, and it is credited with effecting a permanent cure in small animals infected with trypanosomes in 100 per cent. of cases.

Seven persons infected with sleeping sickness, but shewing no clinical symptoms save swelling of the glands, were put under treatment. Two intramuscular injections were given, the doses varying from 0·1 to 0·3 grammes, and the injections being given at an interval of two days. The injections were made into the buttocks.

The injections were followed by severe abscesses, fever, pain, loss of sleep and appetite, and the patients lost condition. Seven days after the second injection the abscesses were opened and a large quantity of pus and unabsorbed emulsion escaped. The abscesses healed slowly.

The glands did not decrease in size after the trixidin injections, and though in three cases trypanosomes disappeared from the blood and the glands, they could be found in the cerebro-spinal fluid.

The author concludes that the drug is not suitable for the treatment of sleeping sickness.

(151) Danysz (J.). **Essais de Chimiothérapie. Combinaisons des Sels d'Argent et des Composés arsenicaux dans le Traitement des Trypanosomiases Expérimentales et de la Syphilis chez l'Homme.** [Chemotherapeutic Experiments. Combinations of Silver Salts and Arsenic Compounds in the Treatment of Experimental Trypanosomiases and of Syphilis in Man.]—*Ann. Inst. Pasteur.* 1914. Mar. Vol. 28. No. 3. pp. 238-256.

The following is an abstract of that portion of the paper which deals with the author's investigations in connection with experimental trypanosomiasis.

In the majority of the experiments the trypanosome of surra was used. Control mice inoculated subcutaneously died as a rule on the fourth or fifth day.

The following compounds were used and for the sake of brevity the author uses symbols given in brackets to designate each :

Dioxydiaminoarsenobenzol chlorargent-argentate (ACA).
Dioxydiaminoarsenobenzol bromo-argentate (ABA).
Dioxydiaminoarsenobenzol iodo-argentate (AIA).
Dioxydiaminoarsenobenzol (ddab).

All the mice received a single injection of one or the other of these drugs on the third day of infection, when trypanosomes were numerous in the blood.

It was found that " ABA " was distinctly more active than " ACA " and " AIA."

The dose which will cure a mouse by injection 60 hours after infection may be placed at 0·07 mgm. The maximum therapeutic dose is 2·5 mgm. The drug is therefore three times as active as " ddab " and 35 times as active as atoxyl.

In view of this fact " ABA " was principally used in subsequent experiments.

The objects of the further experiments were to ascertain the effects of treatment undertaken at earlier and later stages of infection, the effects of repeated small doses which if given as a single dose do not prevent relapses, and to investigate the treatment of relapses.

The experiments lead the author to conclude that (1) recovery can be effected with more certainty and with smaller doses the sooner treatment is undertaken after infection; (2) the administration of a number of small doses is more effective than that of a single large dose.

The dose required to effect a cure when trypanosomes were already numerous in the blood was five or six times that required if administered during the first 24 hours after infection.

In the treatment of relapses the same facts are to be observed as in the treatment of primary infections, with the difference that there are parasites present in the body which are more or less resistant to the action of the drug. Thus the line of treatment indicated is to give several doses at fairly short intervals.

The point is emphasised that the drugs play in reality a secondary part in the destruction of the parasites, the primary part being played by the defenses of the body which are stimulated by the drugs.

Comparative experiments shewed that " ABA" is as active against *T. rhodesiense* and *T. gambiense* as against the trypanosome of surra.

Mice infected with *T. rhodesiense* have been cured by a single injection of 1 mgm. of " ABA," and by 0·04 mgm. when combined with trypanred.

Doses of 1 mgm. and even 2 mgm. of " ABA " only delayed death for a few days in the case of mice infected with *T. dimorphon.* Mice infected with this trypanosome were, however, cured by a mixture of 3 mgm. of " ACA," 2 mgm. of " ABA," and 1 mgm. of trypanred. In another instance 1 mgm. of " ABA " with 1 mgm. tryparosan effected a cure.

The drug " ACA " was found to be far more effective than " 606 " in the treatment of avian spirillosis.

(152) Danysz (J.). **Traitement du Surra par les Composés Arsenicaux et Arséno-Argentiques. Rapports entre les Doses Tolerées et les Doses Curatives.** [The Treatment of Surra with Arsenic and Arsenic-Silver Compounds. The Relationship between the Maximum Safe Doses and the Curative Doses.]—*Bull. Soc. Path. Exot.* 1914. Mar. Vol. 7. No. 3. pp. 200-202.

Mice infected with surra can be cured by various arsenic and arsenic-silver compounds, and in particular by atoxyl, arsenophenylglycin, chlorhydrate of dioxydiaminoarsenobenzol, and the sulphate of bromoargentic dioxydiaminoarsenobenzolate.

The author carried out a number of experiments with the object of ascertaining the ratios of the maximum dose tolerated to the dose sufficient to effect cures by a single injection.

The following ratios were established :
Atoxyl 1 : 1.
Arsenophenylglycin 3 : 1.
Chlorhydrate of dioxydiaminoarsenobenzol 8 : 1.
Sulphate of bromoargentic dioxydiaminoarsenobenzolate 35 : 1.
A number of experiments have shewn that the last drug, which the author terms " 88d," can be injected repeatedly without ill effect.

(153) FROSCH (P.) & KNUTH (P.). **Steigerung der Wirkung des Salvarsans durch Combination mit Optochininum hydrochloricum und Natrium salicylicum bei künstlicher hervorgerufenen Trypanosomenkrankheit der Pferde.** [Increase in the Activity of Salvarsan in Experimental Trypanosomiases in the Horse through Combination with Hydrochloride of Optoquinine and Sodium Salicylate.] —*Berlin. Tierärzt. Wochenschr.* 1914. Feb. 19. Vol. 30. No. 8. pp. 133-134.

The strains used were nagana ' ferox ' and von PROWAZEK'S strain.
These proved fatal to horses in every case within two or three months after inoculation. In the earlier experiments salvarsan was administered in increasing doses, until doses of 7 grammes were given two consecutive days, but without result. The trypanosomes were found to be arsenic-fast when they re-appeared in the blood. The use of salvarsan combined with quinine hydrochloride yielded no results.
Optoquinine is aethylhydrocuprein, and was introduced into practice by MORGENROTH, at whose suggestion the authors employed the drug.
Seven horses were under treatment. The earlier experiments were directed towards ascertaining the effective dose and the best time for the administration. Horse 4, was treated 42 days after infection, Horse 7, nine days, and Horse 6, five days. Horse 8, received protective treatment 5 days before infection, and this was repeated 35 days after infection. Subsequent experiments shewed that the doses used in these experiments were small.
Horse 4.—Trypanosomes disappeared from the circulation rapidly, and on the sixth and seventh days the treatment was repeated, trypanosomes remaining absent from the blood. Unfortunately the animal died from tetanus 17 days later.
Horse 7.—Seventeen days after treatment a relapse occurred, and in spite of energetic treatment others followed, and the animal was destroyed.
Horse 6.—Died on the 15th day after treatment from colic. Trypanosomes had disappeared from the blood.
Horse 5.—Treated on the 15th day after infection. Trypanosomes disappeared from the peripheral blood, and the animal remained free from trypanosomes for four months. The cure was not complete, as relapses occurred which energetic treatment failed to arrest.
Fresh experiments were undertaken with two further animals, Nos. 9 and 11.
In these cases the doses were greatly increased and the method modified. Horse 11, received a single treatment, and No. 9 was treated twice with an interval of three days.
No. 11 was treated on the 6th day after infection and No. 9 on the 7th day. Up to the time of writing (2½ months) the animals had

remained free from trypanosomes and inoculation of their blood into mice has failed to cause infection.

A fuller report was to be made at the Congress of Tropical Medicine at Berlin in April.

(154) WALKER (G. K.). **The Arsenical Treatment of Surra in Horses; Records of Four Cases.**—*Jl. Comp. Path. & Therap.* 1914. Mar. Vol. 27. No. 1. pp. 71-75.

The treatment followed was that described by HOLMES in 1909 in the *Journal of Tropical Veterinary Science.* The animals treated were experimentally infected, and the control animal from which the treated animals were inoculated, and which had been inoculated from an infected dog, died on the 34th day after trypanosomes first appeared in the blood. Death occurred rather sooner than was expected, but the animal was old and weak.

Detailed descriptions of the courses of treatment given in the four cases are described. In general, the treatment consisted in a sub-cutaneous injection of atoxyl of 100 cc. of a 4 per cent. solution, followed by the administration *per os* of from 1·5 to 2·5 gm. of arsenious acid given in bolus. There was an interval of a day between the doses. In the first case the treatment was not well tolerated and the animal undoubtedly died from arsenical poisoning. The other three cases received full sub-toxic doses, but the trypanosomes were not destroyed, and reappeared in each case after two courses of treatment.

In the first case trypanosomes appeared in the blood during the first course of treatment only.

(155) UHLENHUTH (P.) & SEYDERHELM (R.). **Experimentelle Untersuchungen über den Einfluss elektrischer Schwachströme auf Trypanosomen** *in vitro* **und** *in vivo.* [Investigations of the Effect of Electric Currents upon Trypanosomes *in vitro* and *in vivo.*]—*Zeitschr. f. Immunitätsforsch. u. experim. Therapie.* Orig. 1914. Mar. 14. Vol. 21. No. 1/5. pp. 366-377.

A suspension of blood containing *T. equiperdum* was made in salt solution and a current of 15 milliampères was passed through it. The trypanosomes were killed in 10–20 minutes. Before death occurred, the trypanosomes shewed an exaggerated motility. *T. lewisi* was found to offer more resistance to the effect of the electricity than the strain of *T. equiperdum* with which the experiments were carried out. A sub-lethal quantity of electricity reduced the infectivity of the trypanosomes.

Trypanosomes which had been destroyed by the electric current were found to be toxic for mice.

In their experiments with infected animals the authors ascertained the following facts:

If a tourniquet be applied to the leg of an infected rat and the current be passed through the limb, all the trypanosomes are killed. The application of the non-polarisable electrodes for 15 minutes daily to the abdomen and back of a mouse having trypanosomes in its blood caused an almost complete disappearance of the trypanosomes, but after the cessation of the application of the current trypanosomes returned and the infection followed a normal course.

(156) HENNINGFELD (Fr.). **Ueber die Isolierung einzelner Trypanosomen.** [The Isolation of Single Trypanosomes.]—*Centralbl. f. Bakt.* 1. Abt. Orig. 1914. Mar. 21. Vol. 73. No. 3. pp. 228-240.

The author found LINDNER'S method of isolating yeasts impracticable for the isolation of trypanosomes, but succeeded with the capillary tube method of FROSCH. The tubes used had a lumen of ·018 mm. and the glass was ·006 mm. in thickness. A number of different liquids,—broth, salt solution, and the sera of different animals were used to dilute the blood containing the trypanosomes. This diluted blood was drawn into the tube. The tube was examined with an objective of either low or moderate power and a high eyepiece. When a trypanosome was found an object marker provided with a grease pencil was used to mark the portion of the tube containing it. The tube was then cut so as to obtain this portion. Some practice was necessary to acquire sufficient dexterity and speed.

Working with *T. brucei* and *T. equiperdum*, the author found that the parasites retained their vitality longer when the capillary tube method was used than when LINDNER'S method was employed. The proportion varying from 1½ to 3 times. Trypanosomes retained their vitality best when serum was used as the diluting fluid. In spite of the fact that in serum dilutions in capillary tubes the trypanosomes retained their vitality for as long as 23 hours, no multiplication of the parasite was observed in any instance.

A few control experiments shewed that when no moving trypanosomes were discoverable in the diluted blood the mixture was not infective for experimental animals.

In three experiments the placing of the fragment of capillary tube containing a single trypanosome under the skin of mice failed to set up infection.

OEHLER'S method of drawing the fragment of capillary tube into a syringe containing 1 cc. of salt solution was also tried on two occasions, but failure to infect resulted.

The author found it an advantage to use serum as a diluent and to have serum in the syringe for injection of the tube into the abdomen. He also found it an improvement in the method to push the piece of tube into the needle (dry) of the syringe instead of sucking it up with a small drop of liquid. Working in this way the author was able to obtain 70 per cent. of successes.

(157) LUNDIE (A.). **The Detection of Trypanosomes in Animals.**—*Jl. Trop. Med. & Hyg.* 1914. Jan. 15. Vol. 17. No. 2. p. 22.

The author has found the following method to yield good results where plenty of blood is available.

Tubes containing 5 grammes of potassium citrate dissolved in 5 cc. of sterile water are prepared and sterilised. The blood is allowed to run direct into the tubes, which are then set aside in the vertical position. Within half an hour there is always a little clear liquid at the top, and if trypanosomes are present in the blood at all, they will be found there.

The method is said to yield a larger number of positive results than any of the other methods known to the author.

Another advantage claimed for the method is, that it can be used for the study of trypanosomes. The tubes are left until the corpuscles have settled (three days) and the clear liquid is pipetted into a fresh sterile tube. The author has frequently obtained crithidial forms in this way.

It is also said that the life history of trypanosomes in tsetse flies can be studied by imitating the conditions present in the stomach of the fly. This is done by adding hydrochloric acid to make 0·2 per cent. strength. The effect is to convert the blood into a brown jelly. " The addition of a digestive ferment would no doubt complete the culture medium quite successfully. The matter of temperature is simple as the fly cannot possibly incubate its undigested blood at a temperature higher than that of the air. Experiments in this direction promise a certain amount of success and are certainly different from what have hitherto been in vogue."

(158) MARULLAZ (M.). **Contribution à l'Étude des Trypanosomes des Oiseaux, Deux Espèces Nouvelles.** [The Trypanosomes of Birds. Two New Species.]—*Bull. Soc. Path. Exot.* 1914. Feb. Vol. 7. No. 2. pp. 115-117. With 2 text-figs.

Trypanosoma lagonostictae. This parasite was found in smears from the liver and lungs of *Lagonosticta senegala.* The parasites were not seen in the fresh blood, the bird dying two days after arrival at the laboratory in Paris. Only one type of trypanosome was found. The parasites are somewhat stumpy, measuring 22 to 25 microns in length, including the free flagellum of 2 to 3 microns, and 5 to 7 microns in width. The body terminated posteriorly in a sharp point. The nucleus measured about 3 microns. The centrosome is very distinct and the cytoplasm slightly granular. In the anterior portion the granules form four or five very distinct rows converging towards the anterior end of the body. The trypanosomes were very scanty in the preparations from the lungs and liver, and none were found in the spleen.

Trypanosoma liothricis. A single trypanosome of this species was found in the blood of the bird during life, and none were found in films from the organs and bone marrow after death. Cultures were made from the heart blood and trypanosomes developed rapidly. In the cultures small forms measuring 21 by 4·5 microns, intermediate forms measuring 30 by 3, large stumpy forms measuring 34 by 6, and long slender forms measuring 42 by 2 microns were found. Large refractile granules could be seen in the cytoplasm in fresh preparations, but these disappeared after fixation with alcohol and ether, and were replaced by vacuoles in specimens stained with Giemsa.

In stained preparations variable numbers of chromatophile granules could be found, particularly in the anterior portion of the body. The nucleus and centrosome stained well. Crithidial forms were by far the most numerous.

Inoculation of four other birds of the same species failed to set up infection.

LEISHMANIASIS.

(159) WENYON (C. M.). **The Culture of Leishmania from the Finger-Blood of a Case of Indian Kala Azar, with some Remarks on the Nature of Certain Granular Bodies recently described in this Disease.**—*Jl. Trop. Med. & Hyg.* 1914. Feb. 16. Vol. 15. No. 4. pp. 49-51.

Six tubes of NNN medium were inoculated with 2 to 3 drops of blood taken from the finger of a patient in whom leishmania had been found by liver puncture.

Repeated examinations of the blood had failed to reveal the parasite. On the 6th and 11th days the tubes were negative (one was contaminated), but on the 18th day flagellated forms were found in the other five.

This demonstrates the possibility of the invertebrate host becoming infected from peripheral blood. The author states that it is now a fairly common experience in animal experiments to obtain cultures from organs in which the parasite has not been detected microscopically.

The question arises whether such cultures result from some stage of the parasite hitherto unrecognised, or from leishmania which are present in numbers that are too small to permit of recognition by microscopical examination.

On a number of occasions the author has encountered the protoplasmic masses containing purple-staining granules described by ARCHIBALD, STATHAM and BUTLER, and SMALLMAN in smears obtained by liver puncture in animals. As a control to these bodies, uninoculated animals were examined by the same procedure and exactly similar bodies were found, thus doing away with any view that they may be connected with leishmania. The author is convinced that the bodies are merely detached portions of cytoplasm from large cells which are themselves charged with granules.

(160) MAYER (M.) & WERNER (H.). **Kultur des Kala-Azar-Erregers (*Leishmania donovani*) aus dem peripherischen Blut des Menschen.** [The Cultivation of the Cause of Kala Azar (*Leishmania donovani*) from the Peripheral Blood of the Human Subject.]—*Deut. Med. Wochenschr.* 1914. Jan. 8. Vol. 40. No. 2. pp. 67-68.

The authors found parasites in tubes of NNN medium a month after they were inoculated. About a dozen tubes were used, eight of which became contaminated; but the remaining five yielded positive results. Subcultivation was also successful.

The examination of 12 smears of the blood used as seed material failed to reveal the parasite. From three to five drops of blood were used for the inoculation of each tube. This the authors calculate would have been sufficient for from 36 to 60 film preparations.

A further series of culture tubes inoculated about a month after the first failed to develop any growth.

(161) PRINGAULT (E.). **Existence de la Leishmaniose canine à Marseille.** [The Existence of Canine Leishmaniasis at Marseilles.] —*Bull. Soc. Path. Exot.* 1914. Jan. Vol. 7. No. 1. pp. 41-42.

The author has discovered one case out of 50 dogs examined. The

animal was in very poor condition, but it was not possible to make a post-mortem. The method of examination was trephining the femur. Parasites were numerous in the marrow.

(162) LAVERAN (A.). **Au Sujet d'un Cas de Leishmaniose canine signalé à Marseille.** [Regarding the Case of Canine Leishmaniasis reported from Marseilles.]—*Bull. Soc. Path. Exot.* 1914. Mar. Vol. 7. No. 3. pp. 173-174.

Laveran points out that as Marseilles is in daily communication with places in which canine leishmaniasis is known to occur, and since nothing is known regarding the history of the dog, it is quite likely that the animal contracted the infection elsewhere. He thinks that it would be a valuable protective measure to prohibit the importation of dogs from countries where either the canine or infantile form of the disease exists.

(163) YAKIMOFF (W. L.) & SCHOKHOR (N. I.). i. **Recherches sur les Maladies tropicales humaines et animales au Turkestan.** (1) **Répartition de la Leishmaniose canine au Turkestan.** [Investigations regarding Human and Animal Tropical Diseases in Turkestan. (1) The Distribution of Canine Leishmaniasis.]—*Bull. Soc. Path. Exot.* 1914. Mar. Vol. 7. No. 3. p. 185.

(164) ii. **Recherches sur les Maladies tropicales humaines et animales au Turkestan.** (2) **La Leishmaniose cutanée (Bouton d'Orient) spontanée du Chien du Turkestan.** [(2) Cutaneous Leishmaniasis of the Dog in Turkestan.]—*Ibid.* pp. 186-187. With 1 text fig.

i. The authors have examined 647 dogs and have found 157, or 24·26 per cent., infected. They have also encountered 31 cases in man (27 in children and 4 in adults).

ii. After mentioning the previous publications regarding the occurrence of this condition in natural circumstances, and its experimental production, the authors briefly describe a case which came under their own observation. The dog was in a very poor condition, had lost a great part of its coat, and had a purulent discharge from its eyes. On its back there was an ulcer measuring 7 by 5 mm. (microns according to the text), and a slightly larger one on the right side of the neck. The bases of the ulcers were covered with red granulations, in preparations from which, stained with Giemsa, typical parasites were found. Several were very large, measuring 7·85 by 2·35 microns.

The authors recall the fact that the parasites present in cases of oriental boil in Turkestan are according to their own observations: *Leishmania tropica* var. *minor* (Bukhara) measuring 3·92 by 3·14 microns, and *L. tropica* var. *major* (Termese), 5·49 by 3·92 microns. They suggest the name *L. tropica* var. *canina* for the sub-species.

(165) LEMAIRE (G.), SERGENT (Ed.), & LHÉRITIER. **Spécificité de la Kératite observée chez les Chiens atteints de Leishmaniose naturelle.** [The Specific Nature of the Keratitis observed in Natural Cases of Leishmaniasis in the Dog.]—*Bull. Soc. Path. Exot.* 1914. Mar. Vol. 7. No. 3. pp. 193-196.

The authors attach great importance to the keratitis observed in

natural cases of leishmaniasis, and histological examination of the cornea from an infected dog has revealed an interstitial keratitis associated with the presence of parasites. The following alterations were found in the invaded cornea: The anterior epithelium may shew slight thickenings and desquamation at places, but there is no actual ulceration. Immediately beneath the epithelium there are masses of cells and newly formed blood-vessels.

At first sight it appears as if the cornea were composed of stratified layers separated from each other by one or more layers of cells, or by a richly cellular exudate.

The exudate is most abundant in the middle portion of the cornea, where the laminae are separated off into fine fibrils. Lymphocytes containing parasites are to be found in the cellular groups.

The posterior membrane of the cornea is clearly visible. Descemet's membrane is thickened and irregular owing to the presence of rounded cells and large cells containing parasites. With the increasing duration of the lesion the exudate disappears and the corneal laminae undergo a process of fibrosis.

The authors have not been able to find any evidence of secondary infection, and they are convinced that the lesion is specific.

This fact is of great value from the point of view of diagnosis, and even for a retrospective diagnosis, for the reason that a more or less marked opacity is left in cases where recovery takes place spontaneously.

SPIROCHAETOSIS.

(166) VON RATZ (S.). **Spirochaetose des Geflügels.** [Avian Spirochaetosis.]—*Berlin. Teirärzt. Wochenschr.* 1914. Feb. 12. Vol. 30. No. 7. pp. 117-119.

The author records an outbreak of spirochaetosis among fowls, geese, and ducks upon a farm in Hungary. Blood from a fowl received within 48 hours after death set up an infection in one of two fowls inoculated subcutaneously. Spirochaetes appeared in the blood, but subsequently disappeared and the bird recovered.

A diseased duck was despatched alive to the Institute (Budapest), but died before arrival. Spirochaetes could be found in very small numbers in the blood, but it failed to infect fowls by inoculation. The occurrence of the disease in three species of birds simultaneously suggests that *S. gallinarum* and *S. anserina* are identical.

(167) GONDER (R.). **Experimentelle Studien über** *Spironema gallinarum* **und** *Spironema recurrentis*. [Experimental Studies regarding *Spironema gallinarum* and *Spironema recurrentis*.]—*Zeitschr. f. Immunitätsforsch. u. experim. Therapie.* Orig. 1914. Mar. 14. Vol 21. No. 1/5. pp. 309-325.

In a previous paper the author shewed that *T. lewisi*, if arsenic-fast, loses that property when it passed through the natural intermediate host, the rat louse. The same does not hold good for *S. gallinarum*. A strain of fowl spirochaetes which is arsenic-fast retains that property when it is passed through other birds and back into fowls.

The author was able to compare the Soudanese and Brazilian strains of fowl spirochaetes. He found that whereas the Soudanese strain protected against the Brazilian strain the converse did not hold good.

In a few experiments the author obtained the somewhat surprising result that an immune fowl can be reinfected if the spirochaete be passed through a Java sparrow, and conversely an immune Java sparrow can be reinfected after the spirochaete has been passed through a fowl.

(168) Launoy (L.) & Lévy Bruhl (M.). **Evolution de la Spirillose chez la Poule, après Splénectomie.** [The Evolution of Spirillosis in the Fowl after Splenectomy.]—*Compt. Rend. Soc. Biol.* 1914. Feb. 27. Vol. 76. No. 7. pp. 298-299.

Splenectomy is a somewhat difficult operation to perform on the fowl owing to the deep position occupied by the organ. When it is successfully accomplished recovery is complete in from 8 to 10 days, and no disturbance of health is observed.

In a general way the disease follows its normal course in fowls deprived of the spleen, but spirilla appear in the blood sooner than in normal fowls. They may be observed as early as 18 hours after inoculation, while in controls they make their appearance in about 48 hours. Further points are, that spirilla are constantly more numerous in the blood, and two crises occur. The septicaemic stage lasts longer in animals deprived of the spleen than in control animals. It commences 24 hours earlier, and terminates 24 to 48 hours later. There is, however, no increased severity of the disease from the clinical point of view, and in some cases the symptoms of intoxication, dullness, and paralysis are less marked and even unobserved in birds from which the spleen has been removed. This is possibly explained by the view that owing to the absence of the spleen destruction of the spirilla and liberation of toxic substances does not occur to nearly so marked a degree.

Antibodies are produced as in control birds, and the same blood reactions—rapid anaemia, leucocyte variations etc.—occur as in normal fowls.

(169) Arnheim (G.). **Spirochaetenuntersuchungen.** [Investigations regarding Spirochaetes.]—*Zeitschr. f. Hyg. u. Infektionskrankh.* 1914. Jan. Vol. 76. No. 3. pp. 407-441. With 2 plates.

The bulk of this article consists in a description of the author's investigations of the spirochaetes which are responsible for disease in the human subject, but a short section is devoted to the question of the relationship between spirochaetes and swine fever.

Recently King, Baeslock, and Hoffmann have described a spirochaete as being the cause of this disease. The parasite has been found by these authors in the blood and in the intestinal ulcers, and from this they have concluded that the organism and the disease are causally connected. Opposed to this view are the facts that none of the species of spirochaetes discovered up to the present are capable of passing through filters, and further that salvarsan, which is a specific

for spirochaete infections, is ineffective in swine fever. The author carried out a number of transmission experiments with several strains of the virus. Small thick spirochaetes with a few turns were present in the virus, and spirochaetes were discoverable in the blood withdrawn from the caudal artery, but they were not discoverable in the heart blood. They were always present in very small numbers. They were present in the intestine, and at places where there were no diphtheritic lesions. Spirochaetes were also obtained by cultural methods from the mesenteric glands of an infected pig, but the author came to the conclusion that they were derived from the intestine and had nothing to do with the disease.

TOXOPLASMOSIS.

(170) SARRAILHÉ (A.). **Notes sur la Toxoplasmose Expérimentale.** [Notes on Experimental Toxoplasmosis.]—*Bull. Soc. Path Exot.* 1914. Mar. Vol. 7. No. 3. pp. 232-240.

This paper contains the author's observations upon the resistance of *Toxoplasma gondii* outside the body when placed in sterile media and exposed to temperatures between 0° and 37° C., or under the action of various injurious physico-chemical conditions, such as heating to temperatures higher than 40° C., and the effect of distilled water. The effects produced by certain heterologous sera have been investigated in order to ascertain whether they prevent or delay the multiplication of the parasite in susceptible animals. The coefficient of infectivity of the parasite for animals by various methods of infection with very weak dilutions of the virus in physiological salt solution has also been investigated.

In connection with the first of these points it was found that incubation at 37° C. destroys the vitality of the parasite in 24 hours. Maintenance at laboratory temperature for 17 days did not destroy the infectivity of the virus.

In a previous paper the author, in conjunction with MESNIL, stated that the parasite remains living and virulent in carcasses 30 hours after death.

In a new series of experiments it was found that the serous peritoneal exudate of a mouse dead 50 hours previously and swarming with bacteria proved fatal to mice by intraperitoneal inoculation. Exudate withdrawn 80 hours after death failed to set up infection.

It having been found that 24 hours' exposure to a temperature of 37° C. killed the virus, the effect of higher temperatures for shorter periods was investigated.

A quantity of peritoneal exudate was drawn into a pipette and incubated at 45° C. Mice were inoculated at half an hour, one hour, and two hours with this material. All died, but the period elapsing between inoculation and death was increased to 8 days in the first case and 11 days in the last. Control mice died in 5 days.

As the peritoneal fluid was very viscous and contained coarse particles which might assist the parasites in resisting the temperature, pleural fluid, which was much clearer, was used.

A control mouse inoculated with unheated exudate died in 7 days, and two mice inoculated with virus heated for 2 hours at 45° C. died in 13 and 15 days. Peritoneal exudate was mixed with an equal quantity of physiological salt solution, the pipette being kept in a vertical position for an hour. It was then incubated for 2 hours at 45° C. The upper clear liquid and the turbid liquid were each inoculated into two mice. The mice inoculated with the clear liquid died in 7 and 9 days, and those inoculated with the turbid liquid in 7 and 10 days. The control mouse died on the 5th day. Heating either undiluted exudate or a 10 per cent. solution of exudate to 48·5° for two hours was sufficient to destroy the infectivity of the parasite. Similar results were obtained when the temperature was 50° and 52·5° C. In all these cases the mice which failed to become infected with the heated virus were shewn to be susceptible and to have acquired no immunity by a subsequent inoculation with fresh virus.

The following mixtures were injected into mice :

Pure virus drops.	Physiological salt solution drops.	Distilled water drops.
1	10	0
1	9	1
1	7	3
1	5	5
1	3	7
1	1	9
1	0	10

The mixtures were allowed to stand for 5 minutes before being used for the intraperitoneal inoculation of the mice.

The mice inoculated with the first three mixtures and the control mouse died in 5 days. The remaining mice died in 6 days.

A mixture containing 1 drop of virus in 12 drops of distilled water allowed to stand for 15 minutes before inoculation failed to set up infection.

The addition of human serum, serum from a cynocephalus, and from a rat, to the virus failed to prevent infection.

The addition of serum from an infected dog to the virus failed to prevent infection when the mixture was inoculated into mice, even though comparatively large quantities of serum were used.

A virus diluted 1 in 100,000 in salt solution was capable of infecting mice.

A mouse inoculated into the nasal fossae with a few drops of a 1 per cent. solution of virus in physiological salt solution contracted a fatal infection, and died in 10 days.

Two drops of a 1 per 100,000 dilution instilled into each eye of a mouse failed to set up infection. Negative results followed the introduction of this dilution into the nasal fossae and vagina.

As the author has very seldom found the parasite in circulating blood, he withdrew blood from the heart of an infected mouse, mixed it with citrate solution and used doses of 1, 5, and 15 drops for the intraperitoneal inoculation of three mice. All three died, in 10, 9, and 8 days respectively.

(171) Carini (A.) & Maciel (J. J.). **Infections de Toxoplasmose et de Paralysie Bulbaire Infectieuse par les Muqueuses Saines.** [Infections with Toxoplasmosis and Infectious Bulbar Paralysis by Way of Healthy Mucous Membranes.]—*Bull. Soc Path. Exot.* 1914. Feb. Vol. 7. No. 2. pp. 112-114.

This paper contains a brief statement to the effect that the authors have transmitted infectious bulbar paralysis to the rabbit by placing in the conjunctival sac a few drops of blood or tissue-extract from an infected animal.

They have also been able to infect pigeons by smearing the buccal mucous membrane with material containing large numbers of toxoplasms, and also by placing similar material on the eye.

PROTOZOA.

(172) Laveran (A.) & Marullaz (M.). **Sur deux Hemamibes et un Toxoplasme du** *Liothrix luteus*. [Two Haemamoebae and a Toxoplasma of *Liothrix luteus*.]—*Bull. Soc. Path. Exot.* 1914. Jan. Vol: 7. No. 1. pp. 21-25. With 1 text fig.

Of seven birds (*Liothrix luteus*) purchased in Paris three shewed haemamoebae apparently belonging to two different species; two had haematozoa of the toxoplasma type, and in one a trypanosome was found.

The smaller of the haemamoebae appeared to be of the *H. relicta* type (*Proteosoma*), and the larger of the *H. ziemanni* type.

The authors propose *H. tenuis* as the name for the former and *H. liothricis* for the larger.

The toxoplasma found closely resembles that of the sparrow and padda, and the authors suggest the name *Toxoplasma liothricis* for it.

(173) Galli-Valerio (B.). *Smithia talpae* **n. sp. (Piroplasmidae) chez** *Talpa europaea* L. [*Smithia talpae* n. sp. in the European Mole.] —*Centralbl. f. Bakt.* 1. Abt. Orig. 1914. Feb. 25. Vol. 73. No. 2. pp. 142-143. With 1 text-fig.

The parasite described in this paper was found in the blood of a mole received from Malleray (Tavannes Valley, Jura).

Parasites were scanty in smears made from the blood, but possibly this was due to the fact that the blood was coagulated. Specimens stained badly both with Leishman and Bram's azur, although they were stained for 24 hours.

All the parasites were contained in red corpuscles, and two forms were observed: 1. Long pear-shaped parasites measuring from 3 to 4½ microns in length by 1 to 2 in width. The cytoplasm stained faintly blue and the chromatin was disposed at the thicker pole. 2. Round or oval bodies situated for the most part at the periphery of the corpuscles. Single parasites only were found in the corpuscles. The chromatin formed a single small mass placed at the periphery of the parasite or was in the form of a row of minute granules. The parasites measured from 1·5 to 2 microns in diameter. No multiplication forms were observed.

(174) Behrend (K.). **Kurze Angaben über eine nichtpathogene Amöbe aus dem Darm von *Macacus rhesus*.** [A Short Description of a Non-Pathogenic Amoeba from the Intestine of *Macacus rhesus*.]—*Archiv. f. Protistenkunde.* 1914. Mar. 28. Vol. 34. No. 1. pp. 35-38. With 8 text-figs.

Only encysted forms were seen with certainty, but a few other forms were observed regarding which there was some doubt as to whether they were free or encysted.

The cysts varied from 8 to 25 microns in diameter, and they were either round or oval in shape. In some cases the cyst-wall was very thin and in others sufficiently thick as to appear distinctly double-contoured.

The best stained preparations were given by Haidenhain's iron haematoxylin, Böhmer's haematoxylin, and moist Giemsa staining.

The protoplasm presents either a vacuolar or granular appearance, the vacuoles being in some cases very large.

The nucleus contains a caryosome. Specimens containing, 1, 2, 4 and even 8 nuclei were seen.

Chromidial masses are present in the cytoplasm, and these are usually rod-like.

In those parasites which were possibly not encysted the nuclei were indistinct, and the chromidia were either small or absent.

It is impossible to identify the parasite with certainty, but the occurrence of forms containing 8 nuclei suggests that it may be *Entamoeba coli*.

(175) Laveran (A.) & Franchini (G.). **Infezione Sperimentale dei Mammiferi Mediante Flagellati del Tubo Digerente del *Ctenocephalus canis*** [The Experimental Infection of Mammals with the Flagellates from the Alimentary Canal of *Ctenocephalus canis*.]—*Pathologica.* 1914. Jan. 1. Vol. 6. No. 124. p. 1.

Five white mice inoculated intraperitoneally with the contents of infected dog fleas became infected, and nine mice inoculated, some intravenously and some intraperitoneally, with the spleen or liver pulp of a mouse in which the parasites were found also became infected.

The authors were able to transmit the infection through three passages in mice. Seven mice died. The objection that the bacteria introduced with the flagellates contributed to the death of the mice is met by the fact that the infection was transmitted by blood from mouse to mouse and the blood used proved sterile by cultivation.

The disease lasts from 24 to 123 days. There is enlargement of the spleen, but in those inoculated directly from the fleas the numerous bacteria present no doubt contributed to this. Parasites may be found in the liver, blood, spleen, and bone marrow.

They resemble leishmania, and flagellate forms are very scanty. Intracellular parasites were sometimes found.

The authors have also succeeded in infecting a white rat and a dog. The rat was inoculated from an infected mouse, and parasites appeared in the blood two months later. The dog was inoculated intraperitoneally twice, with spleen and liver pulp from infected mice, and once intravenously with blood from a heavily infected mouse. The dog died 50 days after the first inoculation as the result of a complication.

Parasites were scantily present in the liver, spleen, lymphatic glands, and bone marrow. In one smear made from the axillary gland a single flagellate form was found.

(176) SANGIORGI (G.). *Leucocytogregarina cuniculi* **n. sp.**—*Pathologica.* 1914. Jan. 15. Vol. 6. No. 125. pp. 49-50. With 1 text-fig.

The author has discovered this parasite in a domesticated rabbit. The majority of the parasites occurred in a gregarine-like form. They possessed an elongated, slightly curved body with rounded ends. When stained with Giemsa the body appeared blue and finely granular, and contained towards the wider end some little specks of chromatin. The nucleus is oval and is generally placed near the narrower pole of the parasite. The chromatin is in the form of small particles embedded in an unstained matrix. The parasite is surrounded by a definite zone corresponding to a capsule.

The parasites measure 16 to 18 microns in length, by 4 to 5 in width. They are extracellular and are found scattered among the cells in preparations made from the spleen.

More rounded forms with compact-looking nuclei have been observed. Similar forms of smaller size have been observed included within mononuclear leucocytes. No multiplication forms have been seen in preparations made from any of the organs.

RABIES.

(177) KONRÁDI (D.). **Die Vererbung der Wut. iii. Mitteilung.** [The Transmission of Rabies.]—*Centralbl. f. Bakt.* 1. Abt. Orig. 1914. Mar. 30. Vol. 73. No. 4/5. pp. 287-296.

Conclusions :

1. The virus of rabies passes from the mother to the foetus, but becomes attenuated by so doing. In consequence of this rabies develops progressively later in inoculated animals.

2. There appears to be no difference in this transmission in the various species of animals. It occurs in the dog, guinea-pig and rabbit, and probably in other species also.

3. In such investigations the test inoculations must be made subdurally, and guinea-pigs but not rabbits must be used. Guinea-pigs are far more susceptible to rabies, and therefore the experiments fructify more rapidly and with greater certainty than if rabbits were used. If rabbits are employed rabies either develops very late or not at all. This point was left out of consideration by previous authors who were therefore led to false conclusions.

4. The period of observation in the case of foetuses of infected animals must be longer in those cases in which guinea-pigs are used, as the disease develops after a longer interval than when the animals are infected after birth.

5. The virus of rabies is circulating in the blood of the mother at the time when the first symptoms of the disease appear, and even earlier, and it passes the placenta weeks and even months before the death of the mother.

6. The bite of a dog is dangerous 14 days before the onset of rabies.

(178) MANOUÉLIAN (Y.). **Recherches Histologiques sur les Glandes Salivaires dans la Rage.** [Histological Examinations of the Salivary Glands in Rabies.]—*Ann. Inst. Pasteur.* 1914. Mar. Vol. 28. No. 3. pp. 233-237. With 2 plates.

This paper contains an account of the author's investigations of the nerve ganglia in the salivary glands of about a score of dogs affected with street rabies.

Negri bodies cannot be detected in any portion of the gland tissue itself, but they are constantly present, and in large numbers, in the cytoplasm of the nerve cells of the ganglia embedded in the interstitial tissue of the glands.

The author draws attention to the possibility of mistaking débris of gland cells and other bodies for Negri bodies. For example, polynuclear leucocytes which invade the gland tissue in considerable numbers rapidly undergo degeneration. The nucleus fragments and these fragments become acidophile, staining red with Mann's stain. Glandular cells which have undergone hyaline degeneration sometimes contain bodies which may be mistaken for Negri bodies.

The lesions described by NELIS and van GEHUCHTEN as occurring in cerebro-spinal sympathetic ganglia may also be found in the ganglia in the salivary glands.

As shewing how special Negri bodies are to the nerve cells, the author states that at places on the nerve trunks which accompany the vessels in the gland, small groups of nerve cells and even single nerve cells may be found, Negri bodies being found in these cells only, and never in the gland tissue or its secretions.

The following changes are observed in the acini. The acini become invaded by polynuclears, these disintegrate and the whole of contents of the acini are taken in by macrophages. In this way acini are completely changed into masses of macrophages. The cells of the acini appear to undergo a process of degeneration due to the liberation of some substance or substances through the disintegration of the polynuclears.

At places the periacinous connective tissue is also destroyed, and in this way large groups of macrophages are formed. In the ducts similar changes are observed. Large numbers of polynuclears pass into the lumen and disintegrate, and numbers of the cells lining the ducts also undergo disintegration.

These elements are found in the saliva of rabid dogs.

(179) CRUICKSHANK (J. A.) & WRIGHT (R. E.). **A Note on Some Experiments performed with a View to finding out the Period before Symptoms during which the Saliva of an Animal incubating Rabies is infective.**—*Indian Jl. Med. Research.* 1914. Jan. Vol. 1. No. 3. pp. 532-535.

The animals used in these experiments were inoculated subdurally with street virus. The saliva was obtained either from the mouth or by fistula from the parotid and submaxillary glands. Thick suspensions were made of the glands after death which were used for subdural and intramuscular inoculation in doses of 1 to 2 cc. The.

saliva was injected intramuscularly owing to the likelihood of its setting up meningitis if injected subdurally. Negri bodies were looked for in all cases in the hippocampus and cerebellum, and in doubtful cases passage experiments were resorted to.

The details of the experiments performed are given in tabular form.

Conclusions :—

" 1. It is difficult to infect rabbits and guinea-pigs either intramuscularly or subdurally with the saliva of dogs or guinea-pigs in the presymptomatic stage of rabies. The table shows that in one case the saliva of a dog was infective three days before the animal showed symptoms.

" 2. Even when the symptoms of rabies have manifested themselves it is still difficult to demonstrate the infectivity of saliva experimentally. This suggests that the bites of rabid dogs, even under optimum conditions for infection, may not infect because the saliva is not virulent.

" 3. Suspensions of the salivary glands themselves are much more certainly infective under experimental conditions than the saliva derived from them. This is more especially the case for the submaxillary gland.

" 4. Negri bodies are not always demonstrable in the brains of experimental rabid animals, although they may become so after sub-passage."

(180) Pokschischewsky (N.). **Ueber Methoden der Schutzimpfung gegen Tollwut.** [Methods of Immunisation against Rabies.]—*Zeitschr. f. Hyg. u. Infektionskrankh.* 1914. Jan. Vol. 76. No. 3. pp. 453-468.

The author's experiments were undertaken to ascertain whether it is possible to confer active immunity upon animals, and in particular upon dogs, by means of Pasteur's original method, and whether the intraperitoneal inoculation of the fresh brain substance of passage rabbits is capable of setting up active immunity.

The following conclusions are drawn :

1. Pasteur's original method is incapable of protecting dogs and rabbits against subdural and intramuscular inoculation with street virus.

2. A sure method of infecting must be used when the immunity of animals that have been treated is being tested. Such methods are : subdural and intramuscular inoculation. Intra-ocular inoculation is less certain. Very uncertain results are given by subcutaneous inoculation, or by the bites of infected dogs.

3. In testing immunity, in addition to the method of infection, attention must be paid to the type of virus used in the test, whether it is street or fixed virus.

4. Our experiments show that the intraperitoneal inoculation of rabbits and dogs with large doses of fresh fixed virus confers a sure active immunity against intramuscular inoculation with street virus.

5. The original fixed virus inoculated intraperitoneally confers an active immunity upon dogs and rabbits in about 50 per cent. of cases against subdural inoculation, which is the most severe method of infection.

6. The intraperitoneal method of protective inoculation appears to be a promising one for application in practice, for example, for the protection of valuable dogs against the bites of rabid dogs in infected areas. It also forms a firm basis for further investigations regarding the protective inoculation of larger animals, such as the horse and ox.

RINDERPEST.

(181) MONTGOMERY (R. E.). **Report on Double Inoculation against Rinderpest at Lumbwa (East Africa Protectorate, February 1914.)**—MS. Report dated March 30th, 1914. Received through the Colonial Office.

Five thousand seven hundred and forty-five animals were inoculated by Montgomery and the veterinary staff within a period of three days. The total mortality was 37, this figure including all animals dying within three weeks of the inoculations. Many of the deaths were due to causes other than rinderpest. Some animals, probably seven, died from redwater transmitted by the virulent blood used for the inoculations.

A tabulated statement gives the classification of all the stock in the Lumbwa District and each owner gave the number of animals which he knew to be susceptible to rinderpest. These figures cannot be taken as absolutely accurate as one death occurred among draught oxen recorded as being immune.

Bulls. 34 of which 13 were susceptible. Two were imported pure-bred animals. No deaths.

Cows. (*a*) In calf. 769, of which 432 were susceptible. Reactions all normal. No deaths.

(*b*) Heifers in calf. 498, of which 305 were susceptible. Reactions normal and no deaths.

(*c*) Cows not in calf. 693, of which 243 were susceptible. Reactions normal. No deaths.

Four abortions occurred on one farm among 445 in-calf animals. A report regarding the occurrence of abortion following inoculation is to be delayed for a period of three months after the inoculation.

The percentage loss of milk during the week when the reactions were at their height was 9·09 and the following week the yield was normal again.

Work oxen. 1,381, of which 433 were susceptible. One death occurred in a batch of animals believed to be immune.

Young stock. 1,177, of which 1,148 were susceptible. The reactions in these animals were rather more severe and 20 deaths or 1·74 per cent. were recorded.

Calves. 820 were inoculated. All save 11 of these were susceptible. Distinct temperature reactions followed, but the clinical symptoms were mild. There were 16 deaths, of which several were due solely to redwater.

The total death rate was 0·6 per cent., and the death rate among the susceptible animals was 1·09 per cent.

The virulent blood which served as the primary source of infective blood for the inoculations was obtained from a Uganda control at the laboratory.

(182) HARTLEY (P.). **On the Immune Bodies occurring in Anti-Rinderpest Serum, and on the Variations occuring in the Serum Proteins during Rinderpest and during Immunisation and Hyperimmunisation.**—*Mems. Dept. Agric. in India, Vet. Ser.* 1914. Jan. Vol. 1. No. 4. pp. 178-270.

The experiments detailed in this paper were carried out with the

object of discovering some method whereby anti-rinderpest serum could be economically prepared in a stable form.

A certain degree of success has been obtained, in that it has been found possible to prepare in a powdered form those serum proteins which are combined or associated with the immunising substance. The author points out that the study of immune bodies in rinderpest offers greater difficulties than the study of immune bodies in such sera as anti-diphtheritic and anti-tetanic sera, for the reasons that the anti-serum can only be tested against the disease and not against toxin produced outside the body, and also that guinea-pigs and small animals are not available.

It was found that rinderpest immune bodies are precipitated when anti-rinderpest serum is dialysed. The precipitation is complete when tap water is used, but prolonged dialysis (6 days) against distilled water failed to complete the precipitation.

In some cases the rinderpest prophylactic could be prepared in the form of a dry powder which when injected after emulsification conferred protection upon susceptible animals.

Dilute acids exert a deleterious effect upon the immune bodies, but alkalis (0·4 per cent.) do not.

The immune bodies are associated with the euglobulins. They are precipitated by dialysis or saturation with common salt.

They are precipitated on half saturation with ammonium sulphate and are not extracted from the precipitate by saturation with common salt.

The second portion of the paper contains experiments designed to ascertain the quantitative changes occurring in the serum proteins of animals during an attack of rinderpest. The methods used were those described by GIBSON and BANZHAF in 1910.

It was found that the protein-content of the serum of animals of the same species varies considerable. The composition of serum protein of healthy animals may remain constant for periods varying from 11 to 21 days, and is not affected by repeated small bleedings at short intervals.

Examination of serum obtained from animals at intervals during attacks of rinderpest terminating fatally shewed that certain changes occur. The total heat-coagulable protein diminishes. The variations in the absolute amount of albumin per unit volume of serum are the least pronounced. A decrease was observed in the amount of the globulin and of the proteins insoluble in saturated sodium chloride. Comparison of the amounts of albumin, globulin, and proteins insoluble in common salt before inoculation, and just before death, shows that the amount of albumin has increased, and that the globulin and proteins insoluble in salt have diminished.

The third portion of the paper is on the same lines as Part II, but it deals with sera taken during immunisation and hyper-immunisation.

In 11 out of 13 animals the following changes were observed :—

1. The total protein per unit volume increased in all cases.

2. In 10 cases a decrease in the absolute amount of albumin per unit volume was observed.

3. The absolute amount of globulin per unit volume increased in all cases.

4. The most pronounced changes were observed in the proteins insoluble in saturated salt solution. An increase was observed in all cases.

In the other two animals decreases in the globulin group and in the group insoluble in salt solution were recorded. This was probably due to the fact that during immunisation the animals passed through severe attacks of the disease. Repeated large bleedings at short intervals caused a decrease in the total protein, but the various proteins are affected differently. There is little variation in the absolute amount of albumin. Globulin decreases in all cases and a more marked diminution occurs in the proteins insoluble in salt.

In Part II it is shewn that the immune bodies are associated with the latter group, and it is suggested that the large increase in this group which is associated with successful hyper-immunisation indicates an accumulation of immune bodies.

(183) Mrowka (F.). **Studien ueber die Ostasische Rinderpest.** [Eastern Asiatic Rinderpest.]—*Zeitschr. f. Infektionskranhk. parasit. Krankh. u. Hyg. d. Haust.* 1914. Mar. Vol. 15. No. 2. pp. 139-156. With 3 plates.

Rinderpest entirely disappears in Eastern Asia during the hot weather, and reappears with the onset of the cold weather. Sometimes intervals of several years elapse between outbreaks. The disease runs a mild course owing to the high degree of natural resistance offered. Doubts have been expressed as to whether the disease is actually rinderpest or not, but that question has been settled by experiments with animals possessing the ordinary degree of susceptibility.

The slaughterhouse at Tsingtau has furnished ample material for clinical and pathological examinations, but owing to the difficulty associated with the experimental infection of Asiatic animals, and the cost of importing susceptible animals, extensive transmission experiments have not been possible. Clinically the disease presents features which differ greatly from those seen in Germany; they suggest merely a temporary indisposition. The diagnosis is however established by the elevation of temperature, the lesions, and the sterility of the blood as regards visible bacteria, and by its virulence.

If the animals are not slaughtered, recovery almost always follows.

If an animal be killed when the febrile stage has lasted for some days, the typical lesions are found, and partially or completely healed lesions may also be seen. The author has always found fresh and healed ulcers in cases of rinderpest, and though the latter cannot have been produced during the short febrile attack, he concludes that they must be looked upon as typical. Erosion ulcers in the mouth are also pathognomic.

Lesions of the same type were found in apparently healthy animals when slaughtered. They were found in animals born during periods when the disease did not make its reappearance, and in animals which could not have passed through an attack of the disease. They were not found so frequently when a period of about three years had elapsed without an outbreak of the disease. The authors think that

this is without doubt proof of the causal relationship between the disease and the lesions.

Histological examination of the stomach lesions has been made, but the material used was obtained from apparently healthy animals, as no case of rinderpest occurred at the time when the work was being done.

The author concludes from his examinations that the erosions are primarily due to haemorrhages into the mucous coat. The haemorrhages cause local disturbances of circulation and nutrition, and autodigestion occurs. The occurrence of a succession of haemorrhages is responsible for the production of lesions which shew evidence of having been in existence for different lengths of time, and also for their occurrence in animals that are apparently healthy. The submucous coat is never involved, and the ulcerations never cause perforation.

Details are given of an imported animal which was experimentally infected with blood from a native animal. The disease ran the usual course, and the symptoms and lesions were typical.

The occurrence of similar lesions in the stomachs of new-born calves indicates that the infection may be contracted in utero, and this offers an explanation of the insusceptibility of Asiatic cattle to the disease.

Animals that have contracted the disease and recovered may remain sources of infection for long periods, and may form the starting point of fresh outbreaks. Consequently quarantine is not an effective method of controlling the disease.

In this fact also lies an objection to the simultaneous inoculation method of protecting animals.

TSETSE FLIES.

(184) Woosnam (R. B.). **Report on a Search for Glossina on the Amala (Engabei) River, Southern Masai Reserve, East African Protectorate.**—*Bull. Entom. Research.* 1914. Feb. Vol. 4. No. 4. pp. 271-278. With 1 map.

Abstract of conclusions :—

The tsetse fly area on the Amala River presents several points of interest. The species of fly is the Western *Glossina fusca* which has not previously been recorded in the East African Protectorate. The fly appears to be confined to the west bank of the river, or only occasionally strays to the east bank. Natives have been living for years in the district, and their cattle graze to within 400–500 yards of bush where flies exist all the year round, but they have lost only a few animals. Several sportsmen have lost mules and trek oxen.

Two explanations are offered regarding the small losses sustained by natives :

a. The natives may be so familiar with the distribution of the fly, which appears to be confined to definite areas, that they avoid exposing their cattle.

b. A very small percentage of flies may be infected, either because the reservoir is limited, or some climatic influence (such as altitude—5,200 feet) may affect the receptivity (Roubaud) of the fly.

HELMINTHS.

(185) Railliet (A.), Henry (A.), & Bauche (J.). **Sur les Helminthes de l'Eléphant d'Asie. I. Trématodes et Cestodes.** [The Helminths of the Asiatic Elephant. I. Trematodes and Cestodes.]—*Bull. Soc. Path. Exot.* 1914. Jan. Vol. 7. No. 1. pp. 78-83. With 2 text-figs.

1. Trematodes. Four species belonging to this group have been described:—(1) *Fasciola jacksoni* Cobbold 1869—bile ducts and duodenum. (2) *Pseudodiscus hawkesi* Cobbold 1875—large intestine. (3) *Watsonius ornatus* Cobbold 1882—intestine. (4) *Pfenderius papillatus* Cobbold 1882—large intestine.

2. Cestodes. (1) *Echinococcus veterinorum* Rud. 1810. This parasite has been recorded in one instance only—by Bonvincini in 1897. (2) *Anoplocephala manubriata* n. sp. Two specimens of this parasite were found by the authors in 1910. The parasites were apparently incomplete as detached segments and groups of segments were also found. The specimens measured 1·5 and 2·6 centimetres in length, and 1·2 and 1·6 centimetres in width. Some of the free segments found were, however, 4 centimetres wide.

The scolex is large and square measuring 5 to 7 millimetres from side to side. It is somewhat compressed from before behind. There are neither hooks nor rostrum, the four suckers being separated from each other by depressions. The suckers shew concentric markings. The vertical groove is more pronounced, and it is prolonged along the upper and lower surfaces of the worm for a distance of about 3 millimetres and terminates in a shallow longitudinal fossa.

The segments are very short, and, as is often the case with the Anoplocephala, they are united by the central part only, the free edges forming leaf-like projections which to a great extent cover the succeeding segments.

The genital organs are completely developed at a distance of 2 centimetres from the scolex, but the uterus does not contain any eggs at that point. The testicles are small and very numerous. They are disposed in the dorsal portion of the segment and extend across practically the whole width of the parasite. There are two sperm ducts which unite and the single duct terminates in a convoluted vesicle.

The genital pore is situated towards the anterior third of the left side of each segment and takes the form of a little capsule which is directed forwards. The vagina has a fairly large receptaculum about 3 millimetres from the pore. The uterus is transversely placed and has numerous side branches.

Eggs were not found in the segments attached to the parasite, but in the free segments the uterus appeared as a single transverse row of pouches packed with eggs. The eggs had an irregularly circular or slightly polygonal outline, and measured from 70 to 80 microns in diameter. They contained a pyriform structure enclosing an embryo measuring from 17 to 22 microns.

While the worm resembles the Anoplocephala in its general characters, it differs from them in the disposition of the genital glands, but the authors propose to place it in that genus provisionally.

(186) Railliet (A.), Henry (A.) & Bauche (J.). **Sur les Helminthes de l'Eléphant d'Asie. II. Nématodes. A.** [The Helminths of the Asiatic Elephant. II. Nematodes.]—*Bull. Soc. Path. Exot.* 1914. Feb. Vol. 7. No. 2. pp. 129-132. With 1 text-fig.

Ascaridae.—

1. *Ascaris lonchoptera* Diesing, 1851 (*Strongylus elephanti* Rud., 1819),—bile ducts and duodenum.

Strongylidae.—

The parasites found in the elephant and belonging to this family are represented by the *Bunostomeae, Strongyleae, Cylicostomeae.*

Bunostomeae.—

1. *Bathmostomum sangeri* (Cobbold, 1882),—intestine.
2. *Grammocephalus clathratus* (Baird, 1868),—bile ducts and intestine.

This parasite also occurs in the African elephant.

3. *Bunostomum foliatum* (Cobbold, 1882),—gastric tumours and intestine.

This parasite is classified in this genus provisionally.

Strongyleae.—

1. *Evansia renniei* (Railliet and Henry, 1913),—stomach and possibly the bile ducts.
2. *Strongylus additictus* n. sp.

General characters. The body is cylindroid and somewhat attenuated at either end. The anterior end is truncated in a slightly oblique direction. The colour is greyish, but on either side there are reddish brown longitudinal stripes. The cuticle is transversely striated. The mouth is surrounded by a ring of very small plates. The buccal cavity is subglobular measuring 500 microns in length and 450 in width at the widest part. The wall is relatively thick and the anterior edge is surrounded by a distinct collar. This is incised on either side and above and below for the passage of six cephalic papillae. At the bottom of the buccal cavity there are two subventral teeth. 160 microns in length.

The oesophagus is club-shaped and rather less than 2 mm. in length. It is cylindrical for about half its length, and measures 225 microns in diameter. Its posterior extremity shews three bilobed valves.

Male.—The male is 20 mm. in length and about 1·5 in width. The caudal pouch resembles that of the other Strongyleae, but owing to the disposition of the posterior rays it resembles that of Ankylostoma rather than that of Strongylus. The rays are formed of a very long common trunk with poorly developed free portions.

The spicules are rather more than 2 millimetres in length, stout at their base, and taper off in a very marked manner.

Female.—Measures from 18 to 24 millimetres in length and 1·4 to 1·6 in width in front of the vulva, and 1·3 to 1·4 behind it. There is a sudden constriction at the vulva which is situated $\frac{3}{5}$ of the length from the anterior extremity. The vagina is directed forwards, but is soon lost in a convoluted mass of genital tubes. The ovijectors have not been observed. The eggs are ellipsoid, thin-shelled, and at the time of deposition segmentation of the contents is at a very early stage. The eggs measure 65–74 by 42–45 microns. The caudal extremity is in the form of a very obtuse cone and the anus opens 300 microns in front of it.

At two places in this paper the name of this parasite is given as *S. additicius.*

(187) Railliet (A.), Henry (A.), & Bauche (J.). **Sur les Helminthes de l'Eléphant d'Asie. III. Nématodes. B.** [The Helminths of the Asiatic Elephant. III. Nematodes. B.].—*Bull. Soc. Path. Exot.* 1914. Mar. Vol. 7. No. 3. pp. 206-210.

Stongylidae.—

Cylicostomeae. This sub-family is represented by a number of forms which present such marked differences that no doubt special genera will have to be made for them.

For the present, the authors include all, with the exception of one, in the genus *Cylicostomum* Looss (sensu lato).

1. *Choniangium* nov. gen. Cylicostomeae with the anterior extremity obliquely truncated so that the mouth is directed forwards and upwards. Buccal capsule larger in front than behind where the wall is thickened. There is a dorsal tunnel; no internal teeth, but irregular bosselations. Mouth surrounded by a ring of long narrow laminae. Posterior rays of the caudal pouch quadridigitate, the posterior ray being united to that of the opposite side to form a common trunk; the two intermediate rays united, and the external one separate and longer. Spicules long, slender, tubular, and tapering to the extremities which are curved. One accessory piece. Vulva close to the anus. Eggs segmented at the time of oviposition.

Type species: *Sclerostomum epistomum* Piana and Stazzi, 1900.

(1) *Choniangium epistomum* (Piana and Stazzi, 1900),—colon.

(2) *Cylistomum sipunculiforme* (Baird, 1859),—intestine.

(3) *Cylicostomum falciferum* (Cobbold, 1882),—intestine and stomach. This species has also been found in the African elephant.

(4) *Cylicostomum pileatum* n. sp.

General characters. Body cylindroid tapering to both extremities. Cuticle shews coarse transverse striations. At the posterior part of the body the cuticle shews some swellings having wide striations, which must be viewed as a system of secondary markings, and between which a very delicate striation can be seen. The mouth is slightly elliptical in the dorso-ventral direction. The terminal portions of the laminae (36) surrounding it form teeth about 10 microns long.

The buccal cavity is 40 microns deep. The anterior edge has an inner ring of denticulations, equal in number to those in the outer ring. At the bottom there is a third ring of very delicate denticulations. The oesophagus is formed of two subspherical swellings, the posterior of which is slightly the larger. The inner surface is very chitinous and the lumen dilates anteriorly in a funnel-like manner, effecting a wide communication with the buccal capsule. The outer surface of the whole of the anterior dilatation and a small part of the outer wall of the posterior dilatation is covered with a striated capsule 16 microns in thickness.

The wall of the intestine, particularly in the anterior part, is deeply pigmented black.

Male. The authors have had the opportunity of examining a single specimen only. This measured 9·5 mm. in length by 400 microns in width. It was characterised particularly by a long tongue-like appendage representing the posterior lobe of the caudal pouch. Just in front of the bursa there was a vesicular swelling of the cuticle. The spicules were about 2·7 mm. in length, but accurate measurement was impossible owing to the lack of material.

Female. Measures from 11·5 to 14 mm. in length, by 550 to 630 microns in thickness. The caudal extremity is conical and has the cuticular swellings already mentioned. The anus and vulva open 450–500 microns and 700–725 microns respectively from the posterior extremity. The vulva is a transverse aperture 60 microns in length. The vagina is very long and directed forwards. It divides into two parallel ovijectors in the posterior fourth of the body. The eggs are ellipsoid and are provided with thin shells. They measure 67 to 73 microns by 42 to 45 microns, and are deposited in the hollow morula stage.

Spiruridae—

Only one species appears to belong to this family.

Spiroptera smithi (Cobbold, 1882,)—tumours in the stomach with orifices communicating with the interior of the organ.

The authors think that this parasite should be placed in a genus between the Spirura and Acuaria.

Filariidae—

Only one parasite belonging to this family has been described, namely a microfilaria found by Evans and Rennie in the peripheral circulation.

(188) i. Yakimoff (W. L.) & Schokhor (N. I.). **Recherches sur les Maladies tropicales humaines et animales au Turkestan. (4.) Les Microfilaires des Animaux domestiques au Turkestan.** [Investigations regarding Human and Animal Tropical Diseases in Turkestan. (4.) The Microfilariae of the Domesticated Animals in Turkestan.—*Bull. Soc. Path. Exot.* 1914. Mar. Vol. 7. No. 3. pp. 188-189.

(189) ii. Yakimoff (W. L.), Schokhor (N. I.), Koselkine (P. M.), Winogradoff (W. W.) & Demidoff (A. P.). **Recherches sur les Maladies tropicales humaines et animales au Turkestan. (5.) La Microfilariose des Chevaux au Turkestan.** [(5.) Equine Microfilariasis in Turkestan.]—*Ibid.* pp. 189-192.

i. The authors have examined camels, donkeys, mules, cattle, dogs, sheep, and goats for microfilariae, and have found them in the first four species. In four different districts the percentage of camels infected varied from 4 to 22·5. The percentage in the case of donkeys varied from 2 to 3·8. Infected mules were found in one district only, where 2 per cent. were found. Infected cattle were found in two districts, the percentage of infected animals being 5·6 and 15·2. The number of animals examined at each place is not given.

ii. Microfilariae were found in the blood of 41 horses out of 109, which arrived at Taschkent from Termese.

An extensive examination of horses in a number of districts shewed that the disease has a wide distribution. The leucocyte formula of infected horses is as follows :

Lymphocytes	28·6 to 48·8	per cent.
Large mononuclears	0 ,, 1·4	,,
Transitional forms	1·7 ,, 4·3	,,
Neutrophile polynuclears	40 ,, 56·1	,,
Eosinophiles	5·1 ,, 11·7	,,
"Türk" forms	0·5	,,
Myelocytes	0·8	,,

The percentage of infected horses varied from 0·53 to 37·5, but in all cases except the maximum given the number was below 9 per cent.

The parasite is provided with a sheath and there are three (sometimes two) white areas in the cellular column.

The first is at the anterior extremity, is oval in shape and measures from 5·68 to 10·65 microns in length. The second, which is transversely placed and measures 1·42–7·1 microns, is situated at a point 38 to 50 microns from the anterior area.

The third, which is sometimes absent, is irregularly oval and occupies the whole width of the parasite. It is placed from 142–172 microns from the anterior extremity.

The length of the parasite including the sheath varies from 270·45 to 323·76 microns, and excluding the sheath from 158·98 to 266·96 microns. The width including the sheath is from 7·1 to 11·36 microns, and excluding it from 4·24 to 9·94 microns.

At the posterior extremity there is a free portion of the sheath measuring from 4·2 to 78·1 microns.

At the anterior extremity the sheath is also always free, and in one instance in which a measurement was made the free portion measured 21·3 microns.

Three examinations as to periodicity have been made, but none has been observed.

A donkey and a sheep were found to be insusceptible.

The intravenous injection of 4·5 gm. of salvarsan caused a slight diminution in the number of parasites. The parasite is said to correspond most closely with that described by MANDEL, but a detailed description of that parasite is wanting. The chyluria mentioned by MANDEL has never been observed in Turkestan.

In the event of the parasite proving to be a new species the name *Microfilaria Ninae Kohl-Yakimovi* is suggested.

(190) WIRTH (D.). **Filariosen bei einheimischen Pferden.** [Filariae in Native Horses.]—*Zeitschr. f. Infektionskrankh. parasit. Krankh. u. Hyg. d. Haust.* 1914. Mar. Vol. 15. No. 2. pp. 135-138.

After referring to the fact that he has already published descriptions of four cases of equine filariasis, the author proceeds to give details of a fifth case.

The case was brought to the clinique at the Veterinary High School at Vienna, in August 1912, with a history that the animal had been dull for three months and had steadily lost its appetite. The temperature was sub-normal and one micro-filaria was found in the blood.

Two months later the animal was under observation again, but in spite of repeated observations microfilariae were not found. The haemoglobin content of the blood was 75° on Sahli's scale; the red corpuscles numbered 9,792,000 and the white 13,760 per cmm. Differential count of the white corpuscles gave the following percentages: polynuclear neutrophiles 57, eosinophiles 8, lymphocytes 31, and mononuclears 4.

On the author's suggestion BAHNMULLER carried out systematic examinations of horses for microfilariae and found 24 infected out of 280, the horses coming from different parts of Hungary. The following year 5 out of 75 animals were found to be infected.

It is probable that the severity of the symptoms depends upon the number of parasites present in the blood. To what extent mechanical and toxic effects are responsible for the symptoms is not determined.

The identity of the parasite has not been established.

(191) Delanoë (P.). **Au Sujet de l'Existence chez un Saurien, *Agama colonorum* Dum. et Bibr., d'une Filaire et d'une Microfilaire Sanguines.** [The Occurrence of a Filaria and a Microfilaria in the Blood of a Lizard, *Agama colonorum* Dum. and Bibr.]—*Bull. Soc. Path. Exot.* 1914. Feb. Vol. 7. No. 2. pp. 121-125. With text-figs.

Sheathed microfilariae were found in the blood of one lizard out of seven examined. There appeared to be no periodicity.

In moist preparations the sheath is difficult to make out except at the extremities, but the worm can be seen executing wriggling movements within it. Empty sheaths and worms devoid of sheaths were seen.

In stained preparations the worm shewed a transverse striation. Specimens measured about 190 microns in length and 6 in width.

In blood containing adult filariae the author has discovered motionless vermicule-like structures enclosed in very distinct sheaths. At one extremity a small granule with the staining reactions of chromatin could be detected. The author thinks that these bodies are atrophied eggs which have been passed out into the circulation at the same time as the completely developed microfilariae.

A group of 8 adult female filariae was found entangled with each other in the substance of the liver, but there was no degeneration of the liver tissue.

The parasites measured 12–13 centimetres in length by 0·275 millimetres in thickness, they were milky-white in colour, and in moist preparations the uterus could be seen packed with microfilariae in different stages of development.

The mouth is terminal, unarmed, and devoid of papillae. The vagina opens about 0·5 mm. behind the mouth. The cuticle is smooth, and both extremities are obtusely pointed.

OESTRIDAE.

(192) Gedoelst (L.). **Note sur un Nouveau Genre d'Oestride.** [Note on a New Genus of Oestruus.]—*Bull. Soc. Path. Exot.* 1914. Mar. Vol. 7. No. 3. pp. 210-212.

The author refers to the description given by Blanchard in 1893 of a larva obtained from *Boselaphus* (*Bubalis*) *lichtensteini*, to which Blanchard gave the name Kirk's larva. Reference is also made to a larva in the collection at the Natural History Museum, Paris, which was found by Decorse in the sinus of a buffalo in the Chari District in 1903. These appeared to be practically identical with each other. The author has received some larvae from the frontal sinus of a *Bubalis major* forwarded by Dramard. These differ only in secondary characters from Decorse's specimens.

In the present note the author gives the characters which shew that the larvae are a special type of the sub-family Oestrinae.

The body resembles that of Oestruus. The antennary segments are provided with three ocilliform points, parabuccal rings unarmed, spicules exclusively ventral, and placed along the anterior edges of the third to twelfth rings, and arranged in linear groups of four to six spines on either side of the posterior margins of the fifth to eleventh segments. Posterior stigmata of the type of those of Oestruus. The suture which unites the false-stigma at the inner edge of the stigmatic plate joining this obliquely at its lower fourth.

The author suggests the formation of a new genus for these parasites and distinguishes at least two species, *Kirkia blanchardi* for that originally described by BLANCHARD, and *Kirkia surcoufi* for those collected by DECORSE and DRAMARD.

(193) ROUBAUD (E.). **Oestrides Gastricoles et Cavicoles de l'Afrique Occidental Française.** [The Gastric Oestridae and the Oestridae of the Sinuses of French West Africa.]—*Bull. Soc. Path. Exot.* 1914. Mar. Vol. 7. No. 3. pp. 212-215.

The oestrides have been found as parasites in the frontal sinus of *Bubalis major* (Blyth) in West Africa.

(1) *Oestruus variolosus* (Loew). Two adults of this species, described by LOEW in 1863, have been obtained by DRAMARD from larvae derived from *Bubalis major* at Boromo.

The larvae differ from those figured but not described by KING, which were found in a buffalo on the Blue Nile, by the slightly larger areas of spines, and by the absence of intermediate ventral segments, but these differences may be due to the method of preparation or to the manner of figuring.

The larvae differ from those of *Oestruus macdonaldi* Gedoelst from *Bubalis lelwel jacksoni* in the possession of smaller creeping areas which are more regularly attenuated at the sides, and also by the absence of incurvation of the 12th segment. These differences are very marked and distinguish the oestruus of the Katanga buffalo from that of the Sudan buffalo. These two larvae belong to the same group (Oestroides of GEDOELST) and are characterised by the cephalic segment being provided with small spines posterior to the antennal swellings and by the absence of tubercles on the ventral surface of the segments.

When fully extended *Oestruus variolosus* measures from 18 to 23 millimetres. The ventral surface is flat and the dorsal convex with 8 intermediate areas The cephalic segment is provided with a number of short spines arranged in rows on the dorsal surface posterior to the antennal prominences. The other segments are unarmed on the dorsal surface. There are no tubercles on the lateral surfaces. The spines increase in number on the first five segments and decrease on the last two. Two rows of irregular spines on the sides of the first post-cephalic segment : a single one on the median line ; two or three rows on the second ; four or five on the largest posterior sections.

The areas of creeping spines form bands which taper laterally and occupy the greater part of each segment in the middle portion of the body. The spines are in the form of scales with wide colourless bases

and sharp black tips. There are two or three rows on the median post-anal prominence.

(2) *Gedoelstia cristata.* Several adults have been raised by DRAMARD from larvae obtained from Lichtenstein's buffalo. Apparently the parasite has a wide distribution, and it is not specific for the buffalo.

(3) *Kirkia surcoufi.* This parasite has also been found in *Bubalis major* and an antelope (*Cobus defassa*, probably) by DRAMARD and BOUET. Although it has a wide distribution, it is probably not found outside Central and Western Soudan. In Eastern Soudan *Kirkia blanchardi* is no doubt the species which occurs.

CONTAGIOUS PLEUR-OPNEUMONIA and PASTEURELLOSIS.

(194) WALKER (G. K.). **Pleuro-pneumonia of Goats in the Kangra District, Punjab, India.**—*Jl. Comp. Path. & Therap.* 1914. Mar. Vol. 27. No. 1. pp. 68-71.

After reviewing briefly the literature regarding the occurrence of pleuro-pneumonia in goats, the author gives a short description of seven natural cases of the disease and of seven experimental infections. The first goat of the series of natural cases recovered from the disease and subsequently resisted experimental infection with a virulent strain of haemorrhagic septicaemia, and also failed to become infected when nasal discharge from an affected animal was rubbed on its nostrils and mouth. In the remaining six cases cultivation and microscopic examination failed to reveal organisms of any kind.

The seven experimental goats, all of the plains breed, were inoculated with exudate or blood from natural cases, but in every instance the result was negative.

Conclusions.—The pleuro-pneumonia of goats met with in Kangra appears to be identical with the enzootic pleuro-pneumonia of goats described by NOCARD and LECLAINCHE as occurring in Algeria, the Pyrenees, and the Thuringian mountains. The symptoms and lesions are similar, and the failure to transmit the disease from animal to animal is coincident.

The value of the above experiments is depreciated no doubt from the fact that plains animals had to be used. If possible, further investigations with hill goats will be made, with the object of proving the possibility of transmission by means of intrapulmonary inoculation.

(195) MITRA (S. N.). **On a Peculiar Form of Pasteurella in an Indian Elephant.**—*Centralbl. f. Bakt.* 1. Abt., Orig. 1914. Feb. 11. Vol. 73. No. 1. pp. 12-13. With 1 text fig.

The organism that is the subject of this note was isolated from an elephant which had been dead 36 hours before the post-mortem examination was made.

The following lesions were found at the post-mortem: There was a yellow gelatinous exudate in the tissues about the throat. The blood was thick and dark in colour. The pleural and pericardial cavities contained a blood-stained serous exudate. There was marked inflammation of the lungs, and the heart shewed a number of petechiae. The spleen was enlarged, and there were areas of extravasation under the capsule. The pulp was soft. The mesenteric glands were soft and congested. The stomach and intestines were

severely inflamed, the wall of the latter being thickened with exudate.

Microscopic examination of the various organs and fluids shewed a number of diplo-coccoid bacteria and a large number of accidental organisms. Primary cultures were not pure, but pure cultures of the coccoid organism were obtained on subcultivation. The organism was about 0·5 microns in length and stained uniformly. Its cultural characters were those of the fowl cholera bacillus.

A pigeon inoculated with the culture was dead in 8 hours, and pure cultures were obtained from the blood. Two rabbits inoculated endermically with blood from the elephant died in 18 to 24 hours. The lesions presented were those of haemorrhagic septicaemia and the blood contained large numbers of the bacteria. Pure cultures were obtained.

Book Received.

(196) M'Gowan (J. P.). [M.A., M.D., B.Sc., M.R.C.P.E.] **Investigation into the Disease of Sheep called "Scrapie" (Traberkrankheit; La Tremblante) with Especial Reference to its Association with Sarcosporidiosis. With an Appendix on a Case of Johne's Disease in the Sheep.**—xi + 116 pp. Demy 8vo. With 26 figs. 1914. Edinburgh: William Blackwood & Sons. (Edinburgh and East of Scotland College of Agriculture.) [Price not stated.]

[The following list of chapter headings indicates the scope of the book:—History of the disease in Britain. The disease as it occurs in other countries of Europe, and especially in Germany and France. Symptoms and pathology of the disease. Account of a case of Scrapie seen in Germany. The structure and possible developmental stages of the Sarcocyst and their relation to the spread of the disease. Symptoms exhibited by animals heavily infected with Sarcosporidia. On the action of the Sarcocystin, the toxin produced by the Sarcocyst. On the mode of spread of Sarcosporidiosis from animal to animal in carnivorous animals. Method of spread of Sarcosporidiosis in graminivorous animals. Observations as to the presence of Sarcocysts in the muscles of apparently healthy sheep. Epizootiology. Conclusions and recommendations. Appendix on a case of Johne's disease in the sheep. Glossary.]

RECENT LITERATURE.

[Continued from *Bulletin*, Vol. 2, No. 1, pp. 58-60.]

Babesiasis (Piroplasmosis).

(197) NAUDIN (L.). Contribution à l'Etude de la Piroplasmose canine. [Contribution to the Study of Canine Piroplasmosis.]—*Rev. Gén. Méd. Vétér.* 1914. Jan. 1. Vol. 23. No. 265. pp. 18 to 19.

(198) ZIEMANN (H.). Weiteres über die Zuchtung der Malariaparasiten und der Piroplasmen (*Piroplasma canis*) *in vitro*. [Further studies on the Cultivation of the Malaria Parasites and Piroplasms (*Piroplasma canis*) *in vitro*.]—*Arch. f. Schiffs- u. Trop.-Hyg.*, 1914. Feb. Vol. 18. No. 3, pp. 77–93. With one curve.

Filariasis.

(199) SULDEY (E. W.). Existence d'une Filaire et d'une Microfilaire chez le Caméléon de Madagascar. [The Occurrence of a Filaria and a Microfilaria in the Chameleon in Madagascar.]—*Bull. Soc. Path. Exot.*, 1914. Jan. Vol. 7. No. 1, pp. 70–71.

Leishmaniasis.

(200) LIGNOS (A.). La Mortalité par Kala azar à Hydra pendant l'Année, 1911. [The Mortality caused by Kala azar in the Island of Hydra during 1911.]—*Bull. Soc. Path. Exot.*, 1914. Mar. Vol. 7. No. 3, p. 193.

(201) PITTALUGA (G.). Kala azar infantile e Leishmaniosi canina in Ispagna. [Infantile Kala azar and Canine Leishmaniasis in Spain.]—*Pathologica*, 1914. Mar. 1. Vol. 6. No. 128, pp. 121–122.

Rabies.

(202) BORELLINI (A.). Contributo allo Studio della Rabbia nei Bovini. [Contribution to the Study of Rabies in Bovines.] *Moderno Zooiatro.* Parte Scientifica., 1914. Mar. 31. Vol. 25. No. 3, pp. 141–144.

(203) KOZEWALOW (S.). Zur Virulenz des fixen Virus der Tollwut für den Menschen. [The Virulence of the Fixed Virus of Rabies for Man.]—*Centralbl f. Bakt.* 1. Abt. Orig., 1914. Feb. 11. Vol. 73. No. 1, pp. 54–71.

Rabies, False.

(204) VON RATZ (S.). Die Empfänglichkeit der Tiere für Paralysis bulbaris infectiosa. [The Susceptibility of Animals to Infectious Bulbar Paralysis.]—*Zeitschr. f. Infektionskrankh. parasit. Krankh. u. Hyg. d. Haust.*, 1914. Mar. Vol. 15. No. 2, pp. 99–106.

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(206) NEUFELD (F.) & BOCKÖER (E.). Ueber die Wirkung von Salvarsan auf Hühnerspirochäten *in vivo* und *in vitro*. [The Effect of Salvarsan upon the Spirochaete of the Fowl *in vivo* and *in vitro*.]—*Zeitschr. f. Immunitätsforschung. u. experim. Therapie*. Orig., 1914. Mar. 14. Vol. 21. No. 1–5, pp. 331–341.

Trypanosomiasis.

(207) BRUMPT (E.). Réduvides de l'Amerique du Nord capables de transmettre le *Tryp. cruzi*. [North American Reduvids capable of transmitting *Tryp. cruzi*.]—*Bull. Soc. Path. Exot.*, 1914. Feb. Vol. 7. No. 2, pp. 132–133.

(208) FARRANT (A. L.). Notes on Mal de Caderas.—*Veter. Record*, 1914. Mar. 28. No. 1342, pp. 626–628.

(209) LAFONT (A.) & DUPONT (V.). Traitement de la Trypanosomiase Humaine au Sénégal par le Ludyl et le Galyl. [The Treatment of Human Trypanosomiasis in Senegal with Ludyl and Galyl.]—*Bull. Soc. Path. Exot.*, 1914. Feb. Vol. 7. No. 2, pp. 160–171.

(210) LANFRANCHI (A.). Contributo alla Conoscenza della Forma Clinica nell'Infezione Sperimentale da Nagana, negli Equini. [The Clinical Symptons of Nagana in Experimental Cases in Equines.]—*Clinica Veterinaria*, 1914. Mar. 15. Vol. 37. No. 5, pp. 181–190.

(211) SCHILLING (C.). Antigene Eigenschaften verschiedener Stämme ostafrikanischer Trypanosomen. [The Antigen Properties of different Strains of East African Trypanosomes.]—*Zeitschr. f. Immunitatsforsch. u. experim. Therapie*. Orig., 1914. Mar. 14. Vol. 21. No. 1,5, pp. 358–365.

Biting Insects and Ticks.

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Flies.

(213) AUSTEN (E. E.). New African Tabanidae. Part IV.—*Bull. Entomol. Research*, 1914. Feb. Vol. 4. Pt. 4, pp. 283–300. With 5 figs.

(214) ROUBAUD (E.). Parasitisme chez les Reptiles du *Phlebotomus minutus* Rond. var. *Africanus*, Newstead. [Parasitism of *Phlebotomus minutus* Rond. var. *Africanus*, Newstead in Reptiles.]—*Bull. Soc. Path. Exot.*, 1914. Jan. Vol. 7. No. 1, pp. 83–85.

Mosquitoes.

(215) MACFIE (J. W. Scott). A Note on the Action of Common Salt on the Larvae of *Stegomyia fasciata*.—*Bull. Entomol. Research*, 1914. Feb. Vol. 4. Pt. 4, pp. 339–344.

Ticks.

(216) Cunliffe (N.). *Rhipicephalus sanguineus:* Variation in Size and Structure due to Nutrition.—*Parasitology*, 1914. Jan. Vol. 6. No. 3, pp. 372–378. With 4 text figs.

(217) ——. Observations on *Argas brumpti*, Neumann, 1907.—*Parasitology*, 1914. Jan. Vol. 6. No. 3, pp. 379–381. With 1 text fig.

(218) Hindle (E.) & Cunliffe (N.). Regeneration in *Argas persicus*.—*Parasitology*, 1914. Jan. Vol. 6. No. 3, pp. 353–371. With 4 text figs.

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Helminths.

(220) Conor (A.). Essais de Transmission de la Bilharziose. [Attempts to Transmit Bilharziasis.]—*Bull. Soc. Path. Exot.*, 1914. Mar. Vol. 7. No. 3, pp. 202–206.

(221) Nicoll (W.). The Trematode Parasites of North Queensland. I.—*Parasitology*, 1914. Jan. Vol. 6. No. 4, pp. 333–350. With 2 plates.

(222) Velu. Enzootie d'Oesophagostomose bovine au Maroc. [Enzootic Bovine Oesophagostomosis in Morocco.]—*Recueil Méd. Véter.*, 1914. Mar. 30. Vol. 91. No. 6, pp. 125–127.

Protozoa.

(223) Fantham (H. B.) & Porter (Annie). *Herpetomonas stratyiomyiae*, n. sp., a Flagellate Parasite of the Flies, *Stratyiomyia chameleon* and *S. potamida*, with remarks on the Biology of the Hosts.—*Ann. Trop. Med. & Parasit.*, 1913. Dec. 30. Vol. 7. No. 4, pp. 609–620. With 1 plate.

(224) Leger (L.) & Duboscq (O.). Sur une Nouvelle Schizogrégarine à Stades Epidermiques et à Spores Monozoïques. [A New Schizogregarine with Epidermal Stages and Monozoic Spores.]—*Compt. Rend. Soc. Biol.*, 1914. Feb. 27. Vol. 76. No. 7, pp. 296–297.

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(225) Gozony (L.). Die Abderhaldensche Reaktion bei protozoischer und metazoischer Parasiteninfektion. [Abderhalden's Reactions in Protozal and Metazoal Parasitic Infections.]—*Centralbl f. Bakt.* 1. Abt. Orig., 1914. Mar. 30. Vol. 73. No. 4/5, pp. 345–349.

(226) Lucet (Adrien). Recherches sur l'Evolution de l'*Hypoderma bovis* (de Geer) et les Moyens de la Détruire.—*Compt. Rend. Acad. Sciences*, 1914. Mar. 16. Vol. 158. No. 11, pp. 812–814.

TROPICAL DISEASES BUREAU.

TROPICAL VETERINARY BULLETIN.

VOL. 2.] 1914. [No. 3.

BABESIASIS (PIROPLASMOSIS) AND ANAPLASMOSIS.

(228) STOCKMAN (S.) & WRAGG (W. G.). **Cross Immunisation with *Piroplasma bigeminum* and *Piroplasma divergens*.**—*Jl. Comp. Path. and Therap.* 1914. June. Vol. 27. No. 2. pp. 151-155.

This paper contains additional proof of the non-identity of *P. divergens* and *P. bigeminum*, in the form of cross-immunity tests.

In the first experiment detailed in the paper two heifers were used. One of these had been experimentally infected with the South African strain of red-water (*P. bigeminum*) a year previously and the other had never been exposed to infection. Both animals reacted to *P. divergens* to about the same degree, and in the blood of each parasites of the *divergens* type were found from the 3rd to the 6th and 7th days respectively.

The second experiment was carried out with an animal which had passed through a reaction due to *P. bigeminum* (African strain) and six months later had resisted a second inoculation with the same strain. After a further period of six months the animal was inoculated with blood containing *P. divergens*. A slight reaction followed, unaccompanied by any rise of temperature. Parasites of the *divergens* type were found in the blood on the 15th day, and had probably been present earlier, but had not been discovered on account of their small numbers. The absence of a rise of temperature is not significant, as the authors stated in their original communication regarding *P. divergens* that very few animals show a marked reaction to the parasite.

Experiment III. In this experiment an animal which had been infected experimentally with *P. bigeminum* two years previously became infected when inoculated with blood containing *P. divergens*.

In Experiment IV the inoculations were reversed. The animal was first inoculated with *P. divergens*, and seven weeks later with *P. bigeminum*. The experiments were successful in both instances, and the two parasites made their appearance in the blood.

In Experiment V the conditions of experiment IV were repeated and the result obtained was the same. The animal was first successfully inoculated with *P. divergens*, and after a period of seven weeks was infected with *P. bigeminum*.

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Experiment VI. A heifer was inoculated with blood from an animal suffering from a naturally acquired infection with *P. divergens*. A positive reaction followed. Subsequently this animal was twice inoculated with blood from an animal that had been infected with *P. bigeminum*. No reaction occurred. The blood of this animal had, however, been giving irregular reactions with other animals. The heifer was later inoculated with the same *P. bigeminum* strain obtained from another animal, with the result that it became infected.

From this it would appear that the blood which twice failed to infect the susceptible heifer was only intermittently virulent, as it neither infected the heifer nor immunised it against a further inoculation with blood containing the same strain of parasite.

In none of the experiments recorded did either piroplasm immunise animals against the other.

(229) CHAMBERS (F.) & SMITH (J.). **Immunisation of Imported Cattle against Northern Rhodesian Piroplasmosis and Anaplasmosis.**— *Jl. Comp. Path. and Therap.* 1914. June. Vol. 27. No. 2. pp. 155-171. With 2 text-figs. and 6 tables.

The inoculations detailed in this article were carried out at the Maramba inoculation and quarantine station, Victoria Falls. The station was erected for the purpose owing to the fact that very large percentages of previous consignments of imported animals had succumbed to piroplasmosis and anaplasmosis. The station was provided with a dipping tank and every effort was made to render the enclosed land free from ticks. Very few ticks were found on the animals during the second month after their arrival and the further infestation of the station was stopped by dipping.

As it had been found by BEVAN that the Rhodesian anaplasmoses were more virulent than those occurring in Cape Colony, it was decided to immunise the animals by inoculating them first with blood obtained from Pretoria and then with blood derived from local sources.

The first batch of animals was given the second inoculation after an interval of five days only, with the result that the attacks of anaplasmosis due to the two viruses were in part contemporaneous and thus a dangerous state of affairs was produced, as there is at present no drug known which is of any value for the treatment of anaplasmosis. In the second batch of animals the period elapsing between the two inoculations was nine days, and in these animals two distinct anaplasmosis reactions were obtained.

It was found that the younger and poorer cattle were the best subjects for immunisation, the most suitable age being 10 to 15 months.

The most satisfactory method of immunising imported animals against local piroplasmosis and anaplasmosis is to inject subcutaneously 10 cc. of citrated blood containing *Babesia bigeminum* and *Anaplasma centrale*, followed fourteen days later by an injection of 4 to 6 cc. of blood, derived from local sources, containing *Babesia bigeminum* and *Anaplasma marginale*.

(230) LIGNIÈRES (J.). **L'Anaplasmose bovine en Argentine.** [Bovine Anaplasmosis in the Argentine.]—*Centralbl. f. Bakt.* 1. Abt. Orig. 1914. May 27. Vol. 74. No. 1/2. pp. 133-162. With 5 text figs.

1. Anaplasmosis is endemic in certain parts of the north of the Argentine Republic, whence it may be accidentally carried to other areas by infected bovines, which form a veritable reservoir of the virus.

2. *Anaplasma argentinum* is of the same type as *Anaplasma marginale* of THEILER, but a comparative study of the two parasites is necessary before any conclusion regarding their identity or duality can be definitely arrived at.

3. In natural circumstances anaplasmosis does not occur as a pure infection; it is complicated by piroplasmoses—*P. bigeminum* and *P. argentinum*. It appears to be transmitted by the same tick—*Margaropus microplus*. Stomoxys does not act as an intermediary.

4. In order to gain a complete knowledge of anaplasmosis the parasite must be isolated, the pure disease must be studied, and the differential characters between Anaplasma and Piroplasma must be established. It is then easier to follow the different forms that anaplasmosis may take when associated with piroplasmosis.

5. Infection with anaplasmosis is equally successful whether the inoculation be subcutaneous, intravenous, or intramuscular.

6. Anaplasma is easily discoverable in the general circulation, particularly during the final crisis, that is to say when there are clinical symptoms and elevations of temperature. The parasites stain well and uniformly like chromatin by LAVERAN'S or GIEMSA'S methods. They are practically circular, are homogeneous, and vary little in size. They are generally placed at the periphery of the corpuscles. One, two, or three may be found in a single corpuscle, and they may also be found free in the plasma. At first scarcely one per cent. of the corpuscles may contain parasites, but in the later stages 30 per cent. or more may be invaded. The alterations characteristic of acute anaemia are observed in the blood at the same time.

7. Pure anaplasmosis is characterised by one or more irregular febrile crises. The most pronounced, which terminates in death, is accompanied by severe symptoms of acute anaemia, loss of appetite, extreme weakness, rapid emaciation, pallor of the mucous membranes, acceleration of the respirations and pulse, and the faeces are hard and rusty in colour.

It is a curious fact that, in spite of the rapidity and extent of the destruction of the blood corpuscles, the urine never appears to be coloured, a fact observed by THEILER. In the Argentine jaundice is rarely observed.

At the post-mortem the first noticeable thing is the pale colour of the blood, which, however, clots. The tissues are pale and sometimes present an appearance as if the animal had been bled. A yellow discolouration of the tissues is somewhat rarely observed. The muscles retain their bright appearance, but are perhaps a little pale in colour. The spleen is enlarged to two or three times the normal size, the liver is congested, the gall-bladder is enormously distended with thick or fluid granular bile.

The kidneys appear to be normal. There may be albumin in the urine, but no haemoglobin. The lymphatic glands, the alimentary tube, and the lungs do not ordinarily show any important alterations. The heart in a proportion of cases shows a large number of petechiae upon its surface.

8. In natural cases of anaplasmosis the symptoms and lesions of piroplasmosis are observed preceding those of anaplasmosis, and in particular haemoglobinuria and the nervous symptoms.

9. In areas where the disease is endemic indigenous animals suffer from it to a slight extent only.

On the other hand, imported animals, and particularly pure-bred adult animals, die in very large numbers, to the extent that it constitutes a serious obstacle to the improvement of the breeds. When resistance is offered to the disease, the period of convalescence is long, and the disease frequently takes a chronic course.

10. Anaplasma retains its vitality in the blood of recovered animals for long periods, in some cases for more than a year.

11. The first attack of anaplasmosis confers immunity.

12. Anaplasma does not appear to pass into the blood of the foetus.

13. Animals immunised against *P. bigeminum* and *P. argentinum* remain susceptible to anaplasma and vice versa.

14. Blood that is rich in parasites retains its virulence after its temperature has been reduced to - 20° C

15. Anaplasmosis is an entity quite distinct from the piroplasmoses.

16. *A priori* no conclusion can be drawn regarding the identity or duality of anaplasmata encountered in different countries. Definite information can only be based upon a comparative study of the parasites.

17. A diagnosis of anaplasmosis can only be established by the examination of blood taken during the algid period of the disease. If inoculation is resorted to the piroplasmoses must be taken into consideration.

The most useful methods of staining for the examination of blood are Giemsa and methylene blue. In the case of *P. bigeminum* the classical twin pear-shaped parasites will be found. In the case of *P. argentinum* the parasites will be very scanty, small and round, staining especially with methylene blue, or in the form of small twin pears and slightly lanceolated.

In cases of anaplasmosis the parasites will be found, sometimes in very large numbers, at the periphery of the corpuscles, and appearing as small, rounded, homogeneous bodies with the staining reactions of chromatin.

18. Prognosis is always unfavourable. Fat, well-bred, and adult animals are the most susceptible.

19. No specific is as yet known against anaplasmosis. Trypan-blue, which is effectual against *P. bigeminum*, is somewhat dangerous in anaplasmosis.

Sanitary measures must be put into force against anaplasmosis as against piroplasmosis: destruction of ticks, separation of infected from healthy areas. Immunisation will also prove to be of great value in the campaign against the disease.

20. Whatever method of immunisation be employed against either piroplasmosis or anaplasmosis, there can be no doubt that it is preferable to use successive doses of the pure viruses rather than to use blood the value of which is not exactly known. The immunity conferred by using pure viruses is reinforced to a valuable degree by the injection of blood derived from animals naturally infected in endemic areas and containing parasites of the same type as those used for the vaccination.

(231) MELLIS (M. C.). **Contribution à l'Étude du Traitement de la Piroplasmose bovine par le Trypanblau.** [The Treatment of Bovine Piroplasmosis by Means of Trypanblue.]—*Rev. Vét.* 1914. June. Vol. 39. No. 6. pp. 321-334.

Bovine piroplasmosis is responsible for very serious losses among cattle in Northern Africa. The disease makes its appearance about the beginning of the summer and is very variable in its manifestations. It is said that in some cases it terminates fatally within a few hours, while in other cases its onset is very insidious and its course very prolonged. The period of convalescence is very long "in the few animals which escape death."

The author gives details of 23 cases which have been treated with trypanblue.

The cases were treated in ordinary practice, and the diagnosis was not based upon microscopic examination of the blood, but upon the clinical features of the disease.

In 19 out of the 23 cases recovery followed, and in the four cases which terminated fatally the drug was administered subcutaneously. Subcutaneous injection of the drug renders its action slower, the effects not being observed until 24 to 36 hours later. After intravenous injection the effects are observed in 12 to 18 hours.

The author has always used pilocarpine in conjunction with the trypanblue, with the object of hastening the diffusion of the drug in the circulation and combating the constipation which is always observed in cases of bovine piroplasmosis.

None of the treated animals had relapses.

TRYPANOSOMIASIS.

(232) YORKE (W.) & BLACKLOCK (B.). **The Differentiation of the more important Mammalian Trypanosomes.**—*Ann. Trop. Med. & Parasit.* 1914. Apr. Vol. 8. No. 1. pp. 1-12. With 1 coloured plate and 1 chart.

This paper contains a review of the methods that are in use for the identification of different species of trypanosomes. The subject is dealt with under two main headings—the trypanosome as it occurs in the vertebrate host, and the trypanosome as it occurs in the invertebrate host.

Under the first of these headings the following characters are dealt with:—Motility, morphology, pathogenicity, symptomatology, and serum diagnosis.

Under the second heading the following points are considered:— Specific host, anatomical parts of the fly infected, period of incubation of trypanosomes in Glossina, morphological characters of trypanosomes in the tsetse.

Motility. This is influenced by so many variable factors that it cannot be considered as a valuable character in the identification of species.

Morphology. This is considered under two sub-headings: qualitative characters, and quantitative characters. The former are those recognisable by simple microscopic examination, and the latter require mathematical expression for their appreciation. Under the first sub-heading the various parts of the trypanosome are discussed and their value as distinguishing features considered.

With regard to the quantitative characters, the length and breadth, particularly the maximum and minimum length of monomorphic trypanosomes, are considered to be of considerable value. The average length of polymorphic trypanosomes is of little or no value, owing to the great variation from day to day in the type of the majority of the trypanosomes present in the blood.

The breadth of trypanosomes is of importance in some instances. *T. montgomeryi* and *T. congolense* have been distinguished from each other by the difference in their breadth; *T. caprae* differs from *T. vivax* in its heavier build.

The degree of *pathogenicity* and the range of pathogenicity are no longer valuable aids in the differentiation of species, recent work having shown that these are both liable under certain conditions to considerable variation.

Symptomatology is also of little value. A symptom which appears to be characteristic of a trypanosome infection is the formation of plaques in horses infected with dourine.

The reactions given by the various methods of *serum diagnosis* are recognised as being non-specific and therefore of no value for the differentiation of species. The authors have had no experience of cross-immunity as a means of identifying trypanosomes.

Invertebrate host. It appears to be probable that all varieties of tsetse are capable of transmitting most, if not all, of the African pathogenic trypanosomes, and that therefore the identification of the fly transmitting a trypanosome in a particular instance furnishes no evidence as to the identity of the trypanosome.

The part or parts of the fly involved in the development of trypanosomes may be of considerable importance in connection with the identification of trypanosomes. Upon these lines trypanosomes may be classified in three groups: (*a*) Those in which development is limited to the proboscis, (*b*) those in which the process commences in the gut and extends forwards to the proboscis, and (*c*) those in which it commences in the gut and is completed in the salivary glands.

The period of incubation in the fly is dependent upon the temperature and is therefore of no diagnostic value.

Sufficient is not yet known regarding the development of trypanosomes in flies to allow of the morphological changes presented by the parasites in the flies being of any value for the purposes of identification.

Pathogenicity	Development in insect host when known	Where first found	Remarks
›r all laboratory animals	Unknown	Zululand	
,, ,,	,,	India	
,, ,,	,,	Central America	
,, ,,	Transmitted by coitus	North Africa	Causes characteristic 'plaques'
,, ,,	Unknown	South America	
and ruminants only	Limited to the proboscis in glossina	Cameroon	
,,	,, ,, ,,	German East Africa	
,,	,, ,, ,,	Uganda	
to bovidae only	Unknown	Transvaal	
,,	Possibly hippobosca, details unknown	Transvaal	
›wn	Unknown	Uganda	
	,,	N.E. Rhodesia	
nly infected	Intestines of rat fleas and lice	(World wide)	
; for laboratory animals	....	Brazil	Dividing forms not seen in blood ?
for all laboratory animals	Gut and proboscis of glossina	Congo	Probably these trypanosomes are identical
ıe and ruminants only ?	,, ,,	Soudan	
t for laboratory animals	Unknown	N.E. Rhodesia	
for monkeys and pigs only	Proboscis of *Glossina morsitans*	Nyasaland	
e for laboratory animals	Gut and salivary glands of glossina	Gambia	
ıt for laboratory animals	Unknown	N.E. Rhodesia	
,, ,,	,,	Nigeria	
‹e for laboratory animals	Gut and proboscis of glossina *	Senegal	* Roubaud & Bouet's observation
,, ,,	Gut and salivary glands of glossina	N.E. Rhodesia	
,, ,,	,, ,, ,,	Uganda	
,, ,,	Transmitted by coitus	North Africa	

'ABLE GIVING THE SALIENT CHARACTERS OF THE MORE IMPORTANT MAMMALIAN TRYPANOSOM

Morphology						
Qualitative Characters				Quantitative Characters		
Flagellum	Blepharoplast	Nucleus	Cytoplasm	Length in microns	Breadth in microns	
				Min. Max.	Min. Max.	
Always free	....	....	....	18 34	..	
,,	....	....	....	18 34	1·5 2	
,,	....	....	....	18 28	1·5 3	
,,	....	....	....	16 35	..	
,,	**Absent**	....	....	Average 23	1·5	
,,	....	....	Club-shaped	16 31	2 3	E
,,	....	....	**Heavier build than *vivax***	18 32	1·75 4·25	
,,	....	....	....	12 19	1·5 2·5	
,,	**Near nucleus**	....	....	18 50	4 6	S
,,	....	....	....	25 70	2 5	
,,	Near nucleus	....	*Myonemes*	72 122	7 10	U
,,	Near nucleus	....	,,	52 72	5 8·5	
,,	**Rod shaped, transverse**	Junction of ant. and middle thirds	....	Average 24	..	H
,,	**Large ovoid**	....	....	Average 20	..	S
Never free	....	....	....	8 19	Average 1·5	A
,,	....	....	....	10 16	Average 1·5	E
,,	....	....	**Heavier build than *congolense***	10 20	Average 3·3	S
,,	Frequently projects as lateral excrescence	....	....	12 23	..	A
Sometimes free and sometimes not	....	....	....	13 39	..	A
,,	....	....	....	10 33	..	S
,,	....	....	....	8 37	..	
,,	....	**Posterior nuclear forms**	....	14 35	..	A
,,	....	,,	....	12 39	..	
,,	....	,,	....	13 38	..	
,,	....	,	....	14 36	..	

Group	Sub-Group		Trypansome	Date and designators	Synonyms	Motilit
I	A	1	*T. brucei*	1899 Plimmer & Bradford	....	....
		2	*T. evansi*	1885 Steel	*T. soudanense* (1907) *T. venezuelense* (1910)	....
		3	*T. hippicum*	1910 Darling	....	....
	B	4	*T. equiperdum*	1901 Doflein	....	....
	C	5	*T. equinum*	1901 Voges	....	....
	D	6	*T. vivax*	1905 Ziemann	*T. cazalboui* (1906)	Very rapid, tr
		7	*T. caprae*	1910 Kleine	....	,
		8	*T. uniforme*	1911 Bruce	....	....
	E	9	*T. transvaaliense*	1903 Laveran	....	....
		10	*T. theileri*	1902 Laveran	....	....
	F	11	*T. ingens*	1909 Bruce	....	....
		12	*T. tragelaphi*	1913 Kinghorn & Yorke	....	....
	G	13	*T. lewisi*	1881 Kent	....	Very rapid, tr
	H	14	*T. cruzi*	1909 Chagas	....	Tumbling mo
II		15	*T. congolense*	1904 Broden	*T. dimorphon* (1904) *T. pecorum* (1910) *T. confusum* (1909)	....
		16	*T. nanum*	1905 Laveran	....	....
	J	17	*T. montgomeryi*	1909 Laveran	....	....
	K	18	*T. simiae*	1912 Bruce	*T. ignotum* (1912)	....
III	L	19	*T. gambiense*	1902 Dutton	....	....
		20	*T. multiforme*	1912 Kinghorn & Yorke	....	....
		21	*T. nigeriense*	1913 Macfie	....	....
	M	22	*T. pecaudi*	1907 Laveran	....	....
		23	*T. rhodesiense*	1910 Stephens & Fantham	....	....
		24	*T. ugandae*	1913 Stephens & Blacklock	*T. brucei* (Uganda) (1909)	....
		25	*T. equi*	1913 Blacklock & Yorke	....	....

(233) BRUCE (D.), HAMERTON (A. E.), WATSON (D. P.) & Lady BRUCE. **Description of a Strain of *Trypanosoma brucei* from Zululand. Part I.—Morphology.**—*Proc. Roy. Soc.* 1914. June 4. Vol. 87. No. B. 598. pp. 493-510. With 3 plates.

"The object of this paper is to describe as fully as possible the morphology of this new strain of *T. brucei* from Zululand, in order to try to prove its identity with the trypanosome causing disease in man in Northern and Southern Rhodesia, Nyasaland, and German and Portuguese East Africa."

The strain described is one obtained from SHILSTON, Pietermaritzburg, who isolated it from an infected mule at Somkele, in Zululand.

Referring to what is called the 1896 strain of *T. brucei*, the authors quote passages in the original descriptions of this parasite by BRUCE, by KANTHACK, DURHAM, and BLANDFORD, and also by PLIMMER and BRADFORD, indicating that the parasite was dimorphic.

A comparison is instituted between a biometric chart drawn up by SHILSTON based upon the measurements of 400 trypanosomes of the 1913 strain and one constructed upon the measurements of 200 individuals contained in preparations made in 1896. These charts bear a remarkable resemblance to each other, but, as pointed out by the authors, too much importance must not be attached to this resemblance, as the measurements upon which they are based were not made under exactly comparable conditions. Comparison between the pathogenicity of the two trypanosomes for the horse and dog also reveals a close resemblance.

Morphology of the 1913 *strain.*

A table gives the measurements in microns of 1,000 trypanosomes from the monkey, dog, rat and guinea-pig, and a second table (reproduced) gives the average lengths of the parasite in these species:—

Species of animal.	Number of Trypanosomes measured.	Average length.	Maximum length.	Minimum length.
Monkey	160	21·2	31·0	12·0
Dog	260	21·5	32·0	16·0
Guinea-pig	30(?80)	22·9	35·0	17·0
Rat	500	20·8	28·0	17·0

A chart constructed upon the measurements given by the 1,000 trypanosomes of the 1913 strain resembles some of the charts constructed upon the Nyasaland human strain, but differs from others.

A further series of charts is constructed upon the measurements of 500 individuals taken on nine consecutive days in the blood of rats. Some of these charts record the measurements after the passage of the trypanosome through *G. morsitans*, once, twice and three times. The differences between these charts are very slight. Curves are given comparing the 1913 strain of *brucei* and the Nyasaland wild game strain and a certain degree of resemblance is observed.

Conclusions :—

"1. The trypanosome described in this paper under the name of the "Zululand strain, 1913," is the same species as that discovered by Bruce in Zululand in 1894; reported on by KANTHACK, DURHAM and BLANDFORD in 1898; and named *T. brucei* by PLIMMER and BRADFORD in 1899.

"2. As regards its morphology, this trypanosome is absolutely identical with the trypanosome causing disease in man in Nyasaland, the *T. rhodesiense* of STEPHENS and FANTHAM."

Part II.—Susceptibility of Animals.—*Idem.* pp. 511-516.

The Commission had no opportunity of studying the effect produced by the "1913 strain" on the horse, but SHILSTON found that it proved fatal in 35 days. In BRUCE'S "Further Report on Nagana, in Zululand, 1896," it was recorded that two horses were killed by the "1896 strain" in 30 and 49 days respectively.

Two out of six oxen inoculated became infected. One died in 310 days, and the other apparently made a complete recovery. Four out of seven goats became infected and died. The average duration of the disease was 77·2 days. There was no oedema of the face or corneal opacity observed.

Sheep could not be procured for experiment.

Eight monkeys died in from 8 to 65 days (average 29·2).

Seventeen dogs died in from 12–26 days (average 18·5). In eight of these there was opacity of the cornea, and in two swelling of the limbs.

Eight experiments with rabbits are recorded, but six of these were reported by SHILSTON. The average duration of the disease was 32·7 days.

Ten guinea-pigs were inoculated. All became infected and died, but four of them were inoculated more than once before infection was set up. The disease lasted from 15 to 89 days (average 43·7).

Twenty-three rats were inoculated and all died, the average duration of life being 27 days.

These results are compared in tabular form with the results obtained with the strain causing disease in man in Nyasaland. The following tables are slightly abbreviated :—

Zululand strain, 1913.

	Horse.	Ox.	Goat.	Monkey.	Dog.	Rabbit.	Guinea-pig.	White rat.
Average duration in days	38	310	77	29	18	33	44	27
Animals used	3	1	7	8	17	8	10	23

Human strain, Nyasaland.

	Horse.	Ox.	Goat & Sheep	Monkey.	Dog.	Rabbit.	Guinea-pig.	White rat.
Average duration in days	0	134	42	26	34	28	67	30
Animals used	0	1	29	20	25	7	15	21

RECOVERIES.

Zululand strain, 1913.

	Horse.	Ox.	Goat.	Monkey.	Dog.	Rabbit.	Guinea-pig.	White rat.
Percentages	0	83	0	0	0	0	0	0
Animals used	3	6	4	8	17	8	10	23

Human strain, Nyasaland.

	Horse.	Ox.	Goat & Sheep	Monkey.	Dog.	Rabbit.	Guinea-pig.	White rat.
Percentages	0	80	0	0	0	0	0	0
Animals used	0	5	29	20	25	7	15	21

Conclusion :—

"The pathogenic action of *T. brucei*, Zululand strain, 1913, on various animals is so similar, not only in regard to the symptoms during life but also in the *post-mortem* appearances and rate of mortality, to that of the trypanosome causing disease in man in Nyasaland, that it affords another proof that these two trypanosomes are identical."

Part III.—Development in *Glossina morsitans.—Idem.* pp. 526-531. With 1 plate.

Seven experiments were made with laboratory-bred flies. Three of these were positive and four negative. Two experiments made with wild flies both had positive results.

Three hundred and eight laboratory-bred flies were used and 15·3 per cent. were found to be infected. In some cases the number of infected flies in a batch was found to be very small (1 in 58), and in others it was very high (20 in 45).

Of 100 wild flies used in the two positive experiments only 21 were dissected, and of these 5 were found to be infected.

The average period elapsing before the fly becomes infective appears to be 21 days.

Dissection of the laboratory-bred flies used in the positive experiments showed that in two the labial cavity and the hypopharynx contained trypanosomes, and that in one of these and in five others the salivary glands were infected.

None of the laboratory-bred flies used in the negative experiments had any trypanosomes either in the proboscis or in the salivary glands.

The trypanosomes found in different stages of development in the flies agree very closely in morphology with those found in flies infected with the trypanosome causing disease of man in Nyasaland.

Conclusions.

" 1. *T. brucei*, Zululand, 1913, belongs to the same group as *T. gambiense* as regards its cycle of development in the tsetse fly.

" 2. It has been shown that the trypanosome causing disease in man in Nyasaland also belongs to the same group.

" 3. The cycle of development of the Nyasaland and Zululand trypanosomes in *G. morsitans* is so marvellously alike that it affords another reason for believing in the identity of these two trypanosomes."

(234) Oehler (R.). **Untersuchungen über den Dimorphismus von *Trypanosoma brucei*.** [**Investigations regarding the Dimorphism of *T. brucei*.**]—*Zeitschr. f. Hyg. u. Infektionskr.* 1914. Apr. 1. Vol. 77. No. 2. pp. 356-370. With 6 text-figs.

The author applied his method of inoculation with single trypanosomes to a strain of *T. brucei* brought from East Africa by Braun and Teichmann. This strain showed marked polymorphism, and posterior nuclear forms were observed among the short aflagellar trypanosomes.

Forty inoculations into mice with single trypanosomes were made and infection resulted in two instances only. The period of incubation was 6 days in both instances, as compared with 4 to 6 days after inoculation with a large number of trypanosomes.

This proportion of successes was much lower than had been obtained previously with a virulent strain of nagana obtained from Togoland. In that case the successes had numbered 20 per cent. The author ascribes this difference to a difference of virulence in the two strains.

The infections in the two infected mice were as markedly polymorphic as the original strain, and this polymorphism was recognisable from the first day of infection.

The conclusions drawn from these facts are :

1. The dimorphism of *T. brucei* is not due to a mixed infection.

2. The dimorphism of *T. brucei* has probably nothing whatever to do with the differentiation of the sexes.

An account is given of some experiments shewing that a mixed infection may be purified by passing the trypanosomes not only through different species of animals, but even through the same species.

A mixture of a salvarsan-fast strain of the Togoland nagana strain and a salvarsan-susceptible strain of the same trypanosome was inoculated from mouse to mouse in series. By adding salvarsan solution to blood from an infected mouse the two trypanosomes could be recognised in moist preparations, as the salvarsan-fast trypanosomes retained their vitality, while the salvarsan-susceptible trypanosomes rapidly became immobolised. As the number of passages became greater the number of salvarsan-fast trypanosomes decreased, and after about 40 passages they could not be detected in the manner described. The disappearance as judged by this method was not complete, as could be proved by treating a mouse inoculated with such a strain with salvarsan in a dose of 1·0 mgm. This sufficed to kill off the susceptible trypanosomes, but the salvarsan-fast trypanosomes remained and reappeared in the blood.

In the case of antimony tartrate-fast strains the purification of a mixture occurs in the same way, but at a greater rate. The purification of mixture of the type described, and probably of other types also, is due to the difference in the rapidity of multiplication.

Regarding the significance of dimorphism, the author is of the opinion that the changes in shape of the trypanosomes are, so to speak, the anatomical expression of the remittent nature of the disease. He believes that the slender forms herald a multiplication of the trypanosomes and the short, broad forms a remission.

(235) Oehler (R.). **Der Dimorphismus des *Trypanosoma brucei* bei experimenteller Behandlung. [The Dimorphism of *Trypanosoma brucei* in Experimental Treatment.]**—*Zeitschr. f. Hyg. u. Infektionskr.* 1914. June 24. Vol. 78. No. 1. pp. 188-192.

The author produces evidence regarding the connection between the dimorphism of the trypanosome and the remittent nature of the infection.

Mice can be incubated at 35°C. without ill-effect provided they are given water to drink, and infection with trypanosomes does not cause the temperature to rise to a height that proves fatal (38·5°) even in mice kept in an incubator at 35°C.

Mice of the first ten passages suffered from a chronic infection, death taking place in from 20 to 70 days. And the course of the infection was marked by numerous remissions, during which the trypanosomes entirely disappeared from the blood. Broad forms present in the blood increased to a marked extent at the remissions. If such a mouse be placed in an incubator when trypanosomes are more or less numerously present in the blood, a remission with predominating broad forms will be produced in all probability in two or three days.

In mice of the 6th to 10th passage kept at room temperature the disease became acute, but in mice of the same passages kept in the incubator the disease remained chronic, relapses occurred, and dimorphism was marked.

A very similar result was observed with mice of the 20th to 30th passages.

Remissions produced by drugs also coincided with an increase in the proportion of broad forms present, but the proportion was not very high.

Inoculation with the spirillum of recurrent fever on the day following inoculation with the trypanosome also lead to a remission coincident with the increase in the number of spirilla, but in this case no broad forms were discovered.

(236) Bruce (D.), Hamerton (A. E.), Watson (D. P.) & Lady Bruce. **The Trypanosome causing Disease in Man in Nyasaland. Part III. Development in *Glossina morsitans*.**—*Proc. Roy. Soc.* 1914. June 4. Vol. 87. No. B. 598. pp. 516-525. With 1 coloured plate.

The investigation of the development of this trypanosome in the fly was rendered difficult by the fact that it was impossible to find the pupae of the fly in any large numbers. The laboratory-bred flies had therefore to be hatched out of pupae obtained from captive flies. A further difficulty was that flies so hatched are not so strong and healthy as flies hatched out from wild pupae.

Eleven experiments were carried out with laboratory-bred flies. Three were positive and eight negative.

Five experiments were carried out with wild flies and all were positive.

Although only three of the eleven experiments carried out with laboratory-bred flies were positive, infected flies were found in eight of the experiments; the total number of infected flies (found by dissection) was 25 and the total number of flies used was 287. The percentage of infected flies was therefore 8·7. The period elapsing before infected flies became infective varied in the three positive cases from 14 to 31 days. This period was arrived at by subtracting seven days from the period elapsing between the first infected feed and the appearance of trypanosomes in the blood of the experimental animal, seven days representing the period of incubation in the experimental animal.

Attention is drawn especially to the fact that the period elapsing before the flies became infected was very short in one instance—14 days.

Two of the positive results obtained in the five experiments carried out with wild flies were evidently due to the presence of naturally infected flies, as the periods elapsing before the flies became infected were only one and three days. In the other three experiments the periods were 18, 25 and 30 days. In all, 255 flies were used, and of these 9 per cent. were found to be infected.

All flies dying during the course of the experiments were dissected. In the three positive experiments with laboratory-bred flies nine infected flies were found. In none of these were any trypanosomes found in the proboscis, labial cavity, or hypopharynx. In one or other of the flies the proventriculus, fore-, mid- and hind-gut, and salivary glands were found to contain trypanosomes, and in one of them all these parts were found to contain them.

Dissection of the flies used in the positive experiments with wild flies shewed a similar condition of affairs, but there was infection of the proboscis with trypanosomes in five cases. It is pointed out, however, that with trypanosomes numerously present in the salivary glands it would be natural to expect to find some in the proboscis, this term including the hypopharynx. It is further pointed out that in some of the wild flies the infections of the proboscis were due to *T. pecorum*, *T. simiae*, or *T. caprae*.

One of the laboratory-bred flies used in the experiments which gave negative results was found to have trypanosomes in its salivary glands, and no explanation of the failure of this fly to infect can be given. The remainder had trypanosomes in neither the proboscis nor the salivary glands.

The development of the trypanosome in the fly is said to be exactly parallel to that of *T. gambiense* in *G. palpalis*. The fly becomes infective in 14 to 31 days after the infecting meal.

The conclusions drawn are:

"1. The trypanosome causing disease in man in Nyasaland belongs to the same group as *T. gambiense*, the development taking place in the alimentary tract and salivary glands, not in the proboscis, of the fly

"2. The percentage of flies which become *infected* is the same as in *T. gambiense*, 8 per cent.

"3. The percentage of flies which become *infective* is about 1 per cent.

"4. The length of time which elapses before a fly becomes infective varies from 14 to 31 days, average 23 days.

"5. The infective type of trypanosome in the salivary glands—corresponding to the final stage of the cycle of development—is similar to the short and stumpy form found in the blood of the vertebrate host."

(237) YORKE (W.) & BLACKLOCK (B.) **The Identity of *T. rhodesiense* with the Trypanosome of the Same Appearance found in Game.** —*Brit. Med. Jl.* 1914. June 6. pp. 1234-1236.

This paper is called forth by one published by KLEINE, in which the view generally held by German investigators, namely, that the trypanosome occurring in game in Rhodesia and that causing disease in man are not identical, is confirmed. The arguments used by KLEINE in support of his view are examined in detail.

The German investigators agree that the two trypanosomes are morphologically identical and that they cannot be distinguished on the grounds of pathogenicity or method of development in the fly, but they nevertheless believe the parasites to be different. KINGHORN and YORKE are said to have failed to have observed the presence of *T. brucei* in heavily infested *morsitans* areas, but it is pointed out that this assumes that the two parasites are distinguishable from each other.

The second argument used by KLEINE, namely, that the finding of infected animals in certain *morsitans* areas while no cases of sleeping sickness occurred is sufficient to separate the two parasites, is criticised because of the difficulty of ascertaining with absolute certainty that no case of human trypanosomiasis occurs in any particular district. The opponents agree that there can be no question of acquired immunity, but they disagree sharply regarding the possibility that human beings are generally very resistant and only occasionally susceptible, the English authors holding that such may be the case. In support of the English view mention is made of the recent work done in connection with the infection of rabbits with *T. vivax* and that concerning the identity of *T. nanum* and *T. congolense*.

TODD'S observation is referred to, in which a European and two natives were inoculated with blood from a cow suffering from trypanosomiasis of an undetermined type, and it is pointed out that this observation has no actual bearing upon the question, for the very reason that the species of trypanosome used was not determined, and that it was probably either *T. vivax* or *T. congolense*, as these are more commonly found in cattle than the polymorphic type of trypanosome. TAUTE'S experiment conducted upon himself is explicit, and whereas the German observers refer to it as supporting their view that the trypanosomes are different, the English authors consider it as affording strong support to their view that human beings are capable of offering a high degree of resistance to infection with trypanosomes.

Further support of the English view is drawn from the fact that the disease in human beings occurs sporadically in widely scattered areas, and this suggests that there must be some endemic reservoir apart from human beings.

WECK'S observations regarding the susceptibility of the antelope and the possibility of infecting monkeys from the antelope are further evidence in support of the authors' view, because " to assume that the game is infected with two different trypanosomes, alike in every respect with the single exception that one variety is fatal to man whilst the other is innocuous, would be, in our opinion, excessive theorising."

Conclusions :

" In favour, then, of game being the reservoir of human trypanosomiasis in South Central Africa we have the following facts :

" 1. Human beings and game are known to be infected with trypanosomes identical as regards morphology, pathogenicity in laboratory animals, and their development in *G. morsitans.*

" 2. The human trypanosome can be successfully inoculated into game.

" 3. The peculiar sporadic occurrence of the disease in human beings suggests that they were infected from a widely spread reservoir of the infection (the game) rather than from one another.

" In conclusion, we submit that the hypothesis that man enjoys marked natural immunity, and is in consequence to a great extent resistant to infection with this parasite, affords a satisfactory explanation of the distribution of the disease, of its comparative rarity, and of the fact that TAUTE'S attempt to infect himself failed."

(238) WATSON (E. A.). i. **Report on Dourine.**—*Dept. of Agriculture, Canada. Report of the Veterinary Director-General* (F. Torrance, B.A., D.V.S.) *for the Year ending* 31*st Mar.* 1913. Ottawa: Printed by C. H. Parmalee. pp. 81-86.

ii. **The Serum Reactions and Serum Diagnosis of Dourine.**—*Ibid.* pp. 102-107.

i. Particular interest attaches to an outbreak of the disease at Unity, Saskatchewan, which the author investigated from March to July 1912. The cases were very mild, and there was some difference of opinion as to whether they were dourine or not. Very slow progress in the disease was observed, the animals differing little in condition when the author saw them two months after illness had first been observed ; in fact, according to some who had seen the animals, there was actual improvement.

Microscopic examination for the trypanosomes failed, but a positive agglutination reaction was obtained in dilutions up to 1 in 2000, and an increased globulin content in the blood was detected by the acetic acid test (see further paper by Watson). Positive reactions were obtained with blood from other mares, and some died from dourine during the course of the investigations. In one case *T. equiperdum* was discovered.

A tabulated statement gives a brief history of nine animals which came under observation.

In the case of the stallion from which the mares became infected the infection took about a year and a half to develop into a definable malady. Experience shows that in mares the disease may be latent during pregnancy and develop rapidly after parturition, infected animals then being a source of great danger to contacts.

During the period 1906 to 1912 Watson made numerous attempts to infect dogs, rabbits, mice and other laboratory animals with *T. equiperdum*, but without success. Only partial success followed the inoculation of large numbers of rats with a strain of the trypanosome which had been passed through a series of ten foals and had acquired a high degree of virulence. Although some of the rats became infected it was found impossible to carry on the strain.

Finally, after a large number of failures, a mouse was successfully inoculated from a mare upon which successive crops of plaques made their appearance. Subsequently there was no difficulty in carrying on the strain in the laboratory.

In mice death usually occurred on the fourth day, and in rats on the fifth. The virulence of the strain for these animals has increased until rats died in three days, and mice in 48 hours.

The strain has also increased in virulence for the horse. In two instances horses inoculated from rats have shown a heavy blood invasion, and one died from dourine in six weeks. Two dogs which licked the carcase became infected and died.

ii. The following reactions are considered by Watson to be of value for the diagnosis of dourine:—

1. Complement fixation test.
2. Agglutination test.
3. Precipitin test.
4. Acetic acid test.

Complement Fixation Test. The special point about this test as applied to the diagnosis of dourine lies in the method of preparing the antigen. The blood of a number of rats at the height of infection, but before they appear to be dying, is collected. It is defibrinated with glass threads and washed five or six times, the layer containing the trypanosomes being pipetted off each time. The final emulsion of trypanosomes in salt solution is diluted one in ten with salt solution, shaken for two or three days, and then passed through a Berkefeld filter. This filtered liquid constitutes the antigen.

The amboceptor, complement, and antigen are titrated and three tubes are prepared from each sample of serum to be tested. Positive and negative controls with known sera are used in every case, together with the usual general controls.

Agglutination Test. The antigen used in this test is the emulsion described above without filtration. Special care must be exercised in making the emulsion, and it must be rejected if for any reason it shows the slightest tendency to auto-agglutination. This may arise if the blood is collected when the animal is approaching death, if it be contaminated, etc.

A number of stock dilutions of serum are prepared, and from these series of dilutions from 1 in 20 to 1 in 10,000 are made. One cubic centimetre of such dilutions is placed in a series of tubes, to each of which are added two or three drops of the trypanosome suspension. A control tube containing only salt solution is included in the series. The tubes are incubated at 37° C. for one or two hours, and the reactions are noted every half hour.

The Precipitin Test. The antigen used in this test is exactly like that used for the complement test, save that it is not diluted.

In each tube 0·55 cc. of antigen is placed, and the serum is added by means of a capillary tube which is passed through the antigen to the bottom, the serum being then allowed to escape and carry the antigen up the tube without mixing with it. Three tubes should be used in each series so that pure serum, serum diluted 1 in 5, and 1 in 10 may be used. In tubes containing diluted sera the formation of a precipitin ring marks an absolutely specific result.

The Acetic Acid Test. This test is based upon NOGUCHI'S observations regarding the increased globulin-content of the serum and cerebro-spinal fluid in cases of syphilis.

Watson replaces the butyric acid used by NOGUCHI by acetic acid, after having used butyric acid in a number of tests.

One cubic centimetre of serum is placed in a graduated centrifuge tube with 9 cc. of half-saturated ammonium sulphate. The tubes are allowed to stand for an hour, and the precipitated globulin is then sedimented by centrifuging. The clear liquid is then replaced by salt solution, in which the globulin dissolves.

This solution is then distributed into tubes in the following quantities:—1·75, 1·50, 1·25, 1·00, and 0·75 cc. The volumes are then made up to 2 cc. with salt solution, and finally 1 cc. of 10 per cent. acetic acid is added to each tube. The tubes are shaken, incubated for two or three hours at body temperature, and the results read off.

Normal sera give a slight opalescence in the first tube, and perhaps a faint cloudiness in the second, but with dourine sera there is marked cloudiness which gradually increases and after 24 hours settles to the bottom as a precipitate.

If more concentrated solutions are used the reaction occurs more quickly, but the differentiation is scarcely as well defined.

In cases of dourine a positive reaction may be obtained in the early stages of the disease. A reaction has been obtained a fortnight after experimental inoculation in a horse.

Watson has carried out the test with sera derived from cases of coital exanthema, glanders, influenza, fistulous withers, and one case of swamp fever. In the last-named a positive reaction was obtained. When the serum was tested by agglutination for dourine the result was negative.

The principal value of this test, perhaps, lies in the exclusion of dourine, for in no case of dourine of known history has the test ever given a negative result.

(239) Graham (L. W.) & Hutchison (R. H.). **The Influence of Experimental Trypanosomiasis upon the Body Temperature of White Rats.**—*Amer. Jl. of Trop. Dis. & Prevent. Med.* 1914. May. Vol. 1. No. 11. pp. 760-775. With 3 plates comprising 7 charts.

The experiments detailed in this paper were designed to investigate the question of the variations of body temperature in the rat under normal and abnormal conditions, and also after infection with trypanosomiasis.

The records were made with thermo-electric couples, a modification of the thermopile, as the mercury thermometer is not sufficiently sensitive. The operation of the apparatus depends upon the fact that when a junction of two dissimilar metals is heated a current is generated, such current being capable of measurement. The method is said to be accurate to one-tenth of a degree centigrade.

Readings of body temperatures were made at short intervals over comparatively long periods in normal rats kept under three sets of external conditions with regard to temperature, viz., room temperature, 37° C., and refrigerator temperature.

A similar series of readings were then taken with the same rats after infection with trypanosomiasis, and experiments were made both with pathogenic and non-pathogenic trypanosomes. The pathogenic trypanosomes used were *T. equinum*, *T. brucei*, and *T. evansi*, and the non-pathogenic *T. lewisi*.

The following conclusions are drawn :—

"1. In white rats experimental trypanosomiases cause no rise in body temperature.

"2. Pathogenic trypanosomes of high pathogenicity seem to decrease the power of thermal regulation in white rats under the influence of prolonged cold; but the non-pathogenic form, *T. lewisi*, does not show this effect.

"3. In white rats at ordinary temperature and under the influence of prolonged heat, none of the trypanosomes used in these experiments had any effect upon thermal regulation.

"4. From observations made upon the blood of infected rats it seems that conditions of prolonged heat and cold may possibly decrease the virulence of pathogenic trypanosomes without diminishing their pathogenicity."

(240) NOELLER (W.). **Die Uebertragungsweise der Rattentrypanosomen. II Teil.** [The Method of Transmission of the Rat Trypanosome. Part II.]—*Arch. f. Protist.* 1914. June 17. Vol. 34. No. 3. pp. 295-335. With 2 plates and 3 text-figures.

Conclusions :—

1. Fleas become infected more easily upon freshly infected rats than upon rats suffering from chronic trypanosomiasis.

2. The flea of the fowl can live for weeks upon rat blood. It does not come into consideration as an actual transmitter of the rat trypanosome, as it passes little or no faecal matter during the process of feeding.

3. The developmental forms of the rat trypanosome observed by PROWAZEK, BALDREY, and RODENWALT in the rat louse can be discovered with ease if the lice examined are taken from rats during the first week of infection.

4. In view of the fact that infectivity is soon lost after rat lice are removed from infected rats—according to GONDER in 20 days—the rat louse cannot be described as the true intermediate host of the parasite, if the view is held that a cycle of development must take place in the true carrier.

5. The rat louse excretes trypanosomes with the faecal matter.

6. Trypanosomes only find their way into the body cavity of the infected rat louse if the intestinal canal suffers injury.

7. Persistence of the trypanosomes in the rat louse, such as would be necessary for the production of a chronic infection of the louse, does not occur.

8. In the sheep ked (*Melophagus ovinus*), which can be fed upon rat blood for weeks, the trypanosomes retain their vitality for two days at 25° C., even if the ked has fed upon the blood of non-infected rats in the interval. Subsequently trypanosomes cannot be discovered in the ked. After 24 hours transition forms make their appearance in the ked, which resemble the so-called male trypanosomes from Glossina.

9. *Leptomonas ctenocephali* occurs in the larvæ of the dog flea also.

10. Among other parasites observed in the dog flea were: *Malpighiella refringens*, Minchin, and *Nosema pulicis*, Nöller. The gregarine *Actinocephalus parvus*, Wellmer, found in the dog flea larvae was probably derived from larvae of fowl fleas.

11. The following protozoa were observed in the fowl and pigeon fleas: Leptomonas spec., which occurs very frequently in the hind gut of full-grown fleas and larvae; *Legerella parva*, Nöller, 1913, in the Malpighian vessels of an adult flea; *Actinocephalus parvus*, Wellmer, in the intestines of all the larvae examined.

(241) Brown (W. H.). **A Note on the Pathogenicity of *Trypanosoma lewisi*.**—*Jl. Exp. Med.* 1914. Apr. Vol. 19. No. 4. pp. 406-410.

Attention is drawn to the fact that other authors have placed upon record the occurrence of pathogenic and non-pathogenic strains of *T. lewisi*, both as regards the rat and as regards the mouse.

The author has encountered a strain of *T. lewisi* which for a time shewed a marked increase in virulence for the rat.

A strain of the trypanosome, the origin of which was not known, but which had been carried on for several years in white rats without shewing any unusual pathogenic effects, appeared to acquire a degree of virulence which rendered it fatal to rats by intraperitoneal inoculation with a drop or two of infected blood.

Of eight rats inoculated intraperitoneally with 0·2 cc. of defibrinated blood mixed with 0·8 cc. of salt solution, two died on the sixth day, one on the seventh, and the remainder on the ninth day after inoculation. The symptoms shewn were torpidity, weakness, anaemia, dyspnoea, in some cases blood-stained nasal and lachrymal discharges, and in all cases diarrhoea.

Careful examination failed to reveal any cause of death other than trypanosomiasis.

At the post-mortem examination the rats shewed acute enteritis, splenic enlargement, hyperplasia of the bone marrow, and a few necrotic foci in the liver. Some of the rats shewed congestion of the lungs, but in no case was there any pneumonia.

Immune and control rats remained healthy.

A number of observations have been made upon normal and immune rats inoculated with different strains of *T. lewisi*, and these shew that such conditions may occur frequently in a series of inoculations, while they do not occur in control or immune rats or in rats inoculated from other sources. With one exception symptoms of the same nature have not been observed in rats placed in contact with rats exhibiting them. In sub-inoculations the strain became less virulent again.

(242) Brown (W. H.). **Morphological and Developmental Anomalies of a Pathogenic strain of *Trypanosoma lewisi* and their Relationship to its Virulence.**—*Jl. Exp. Med.* 1914. June. Vol. 19. No. 6. pp. 562-569. With 2 plates comprising 22 figures.

The strain of *Trypanosoma lewisi* referred to in the previous paper was found to possess several morphological and developmental peculiarities. Attention was first drawn to the possibility of some connection existing between the pathogenicity and the morphology of *T. lewisi* by Wendelstadt and Fellmer, who passed the trypanosome through cold-blooded animals and thus produced certain alterations in these characteristics. The author, therefore, followed up his pathogenic strain of *T. lewisi* through 82 rats, special attention being paid to the nature of the infection.

The details of experiments in which different series of infections were compared with parallel series in which a typical strain was used are reserved for another paper.

In the present paper only those deviations from the normal are described which were pronounced and occurred with sufficient frequence to be considered characteristic of the particular strain or infection. Most of the peculiarities have been observed before, but some of them are comparatively rare.

Two different types of multiplication forms were observed in addition to the usual forms. Figures are given which represent the two types, but it is a little difficult to appreciate what are the special characters of the multiplying forms. It is said that the trypanosomes may multiply very rapidly, producing a large number of irregular or small forms, or they may multiply slowly, the process continuing beyond the period at which it usually comes to an end.

Trypanosomes were found which possessed certain morphological features which were not normal. The variations observed involved all the structural features of the organism. The occurrence of trypanosomes containing no nuclei is referred to, and the occurrence of trypanosomes devoid of centrosomes is somewhat emphasised.

It is suggested that there is a correlation between the morphological and developmental characters and the virulence of the organism.

(243) Laveran (A.) & Roudsky (D.). **Contribution à l'Etude de la Virulence du *Trypanosoma lewisi* et du *Tr. duttoni* pour Quelques Espèces Animales.** [The Virulence of *T. lewisi* and *T. duttoni* for Various Species of Animals.]—*Bull. Soc. Path. Exot.* 1914. June. Vol. 7. No. 6. pp. 528-535.

In this paper the authors give brief details of a number of experiments in which rodents of different species were inoculated with *T. lewisi* and *T. duttoni*, and the following summary is given :—

When small rodents such as wood-mice, voles, dormice, meriones, gerbils, jerboas, and guinea-pigs are inoculated intraperitoneally with the blood of rats rich in *T. lewisi*, there is as a rule produced an infection of variable intensity. In some cases the trypanosomes are very scantily present in the blood and disappear in 24 to 48 hours, and in other cases there is a well-marked infection, trypanosomes increasing in numbers, dividing forms being numerous, and the blood invasion being persistent. Even in those cases in which the infection is abortive, it is not a simple matter of the trypanosomes simply passing into the blood, but an actual infection, as the animals thereby acquire immunity to *T. lewisi*.

In rodents other than rats, inoculations in series with *T. lewisi* have not succeeded, but examination of the records of the infections of rodents with *T. lewisi* suggests that it would not be difficult to obtain strains of *T. lewisi* acclimatised for different species, in the same manner as one can obtain strains of *T. lewisi* inoculable in series for the mouse and strains of *T. duttoni* inoculable in series for the rat.

(244) Yorke (W.) & Blacklock (B.). **Observations on a so-called Cure for Trypanosomiasis.**—*Ann. Trop. Med. & Parasit.* 1914. Apr. 21. Vol. 8. No. 1. pp. 51-53.

At the request of the British South Africa Company the authors have tested a serum supplied by H. C. Sieg and reputed to be of great value for the treatment of trypanosomiasis. The conclusion drawn is that the sera supplied had not the slightest therapeutic value in animals experimentally infected with pathogenic trypanosomes.

(245) YORKE (W.) & BLACKLOCK (B.). **Antimony trioxide in the Treatment of experimental Trypanosomiasis.**—*Ann. Trop. Med. & Parasit.* 1914. Apr. 21. Vol. 8. No. 1 pp. 55-72.

The antimony trioxide—"trixidin"—used in the experiments detailed in this paper was in part supplied by KOLLE and in part prepared by the authors.

The drug was administered by intramuscular injection in the majority of cases, but in some instances intraperitoneal and intravenous injections were made. For the intramuscular injections 10 and 40 per cent. suspensions in oil were prepared. For the intraperitoneal injections 1 per cent. suspensions in salt solution were employed. For the intravenous injections the drug in a very finely divided form was suspended in distilled water. This was allowed to stand for 18 hours, the liquid then being drawn off and estimated as to the quantity of the drug present in it.

The best results were obtained by intramuscular injection, but it was found that the amount of the drug absorbed was extremely small. Six months after administration it could be found at the seat of injection in an unaltered condition. The drug was immediately deposited from the suspension used for the intravenous injections and caused plugging of the veins.

A great disadvantage of the intramuscular administration was that in many cases it gave rise to the formation of sterile abscesses.

Small animals appear to be far more tolerant of the drug than large ones. At least 1 mgm. per 10 gm. body weight can be administered to rodents without untoward results. Such doses administered to donkeys and dogs frequently caused death, and far smaller doses were always followed by abscess formation at the seat of injection.

In cases in which the administration of the drug caused a disappearance of trypanosomes from the circulation there were sometimes relapses after very long periods, amounting to more than a hundred days.

The following strains of trypanosomes were used:—*T. rhodesiense*, *T. brucei*, *T. ugandae*, *T. evansi*, *T. equiperdum*, *T. congolense*, *T. equinum*, *T. gambiense*, and *T. lewisi*. With the exception of the last two of these all the strains appeared to be very susceptible to the drug, trypanosomes disappearing from the circulation within 48 hours after the injection. The strains of *T. gambiense* and *T. lewisi* proved to be very refractory. Relapses occurred even among the susceptible strains, and in the case of the following trypanosomes such relapses occurred after trypanosomes had disappeared from the blood for a period of 100 days or more: *T. rhodesiense*, *T. ugandae*, *T. vivax*, and *T. equiperdum*.

In agreement with what was observed regarding the curative effect of the drug upon *T. rhodesiense* and *T. gambiense*, it was found that it exerted a prophylactic effect against the former, but not against the latter.

(246) LURZ (R.). **Heilungsversuche mit Salvarsan bei Schlafkrankheit.** [The Curative Treatment of Sleeping Sickness with Salvarsan.]—*Arch. f. Schiffs- u. Tropen.-Hyg.* 1914. May. Vol. 18. No. 10. pp. 335-339.

This paper records the results obtained in the treatment of 16

cases of the disease, most of which were in the advanced stages. The dose generally employed was 0·3 gm., and it was repeated in from one to four days, but on some occasions slightly larger doses were given.

In some cases repeated injections produced no symptoms, but in others there was fever, associated with pains in the head, thorax and abdomen, vomiting, and in one instance pains in the joints. The symptoms began to disappear in about five hours.

In every case the treatment caused a reduction in the size of the glands and a disappearance of trypanosomes from the blood.

The patients were kept under observation for periods varying from three and a half to five and a half months.

The following is a resumé of the results :—

One patient in whose spinal fluid trypanosomes had been found died. In six cases relapses occurred, but the general condition of the patients remained unaltered. In one case there was marked loss of condition, but trypanosomes were not found in either the blood or the cerebro-spinal fluid. In the remaining eight cases trypanosomes were not again observed.

Improved results were not obtained when mercury was used in conjunction with the salvarsan.

(247) VORWERK. **Versuche mit Salvarsan bei Schlafkrankheit.** [Experiments with Salvarsan in the Treatment of Sleeping Sickness.]—*Arch. f. Schiffs- u. Tropen.-Hyg.* May. Vol. 18. No. 10. pp. 329-335.

This paper gives the results obtained in the treatment of twelve cases of sleeping sickness in German East Africa. The majority (ten) of the patients shewed glandular swellings, but were otherwise in good condition (second stage). The remainder were at more advanced stages of the disease.

The drug was administered by intravenous injections in doses of 0·4 grammes.

The following conclusions are drawn :

1. A single administration of a moderate dose of salvarsan intravenously during the second stage of the disease causes the immediate disappearance of the trypanosomes from the glands and the circulation.

2. Relapses occur in almost every case after intervals varying from a fortnight to six months, whether single or repeated doses are administered.

3. The drug is contra-indicated in the case of patients in the third stage of the disease—that is to say, when they are in poor condition or show nervous symptoms, as it is dangerous.

4. Salvarsan is of less value for the permanent cure of the disease than atoxyl, treatment with which has not infrequently been followed by long periods during which the patients have been free from relapses.

(248) MACFIE (J. W. Scott). **On the Pathogenicity of the Trypanosome (*T. nigeriense*) from a Case of Sleeping Sickness from Eket, Southern Nigeria.**—*Ann. Trop. Med. & Parasit.* 1914. April. Vol. 8. No. 1. pp. 29-39.

This paper contains an account of further experiments with the trypanosome isolated by FORAN from cerebro-spinal fluid from a case of sleeping sickness at Eket.

The trypanosome was originally isolated by inoculation of a guinea-pig. Some of the experimental inoculations were made with the blood of two further guinea-pigs inoculated from this one, and also from a monkey apparently deriving its infection from the same source.

Of eight rats inoculated only one became infected, and in this animal only a single trypanosome was found on the 59th day.

Seven wild mice were inoculated. Four became infected, but the trypanosomes were very scantily present in the blood. The period of incubation was five to nine days. The disease ran a very chronic course, and did not appear to be responsible for death in any instance.

Three out of twelve guinea-pigs inoculated became infected. Parasites were fairly constantly present in the blood but never in very large numbers. The period of incubation was 27 days, and in one case the animal died on the 158th day.

In one dog out of seven trypanosomes were found on the 85th day and were subsequently found to be present in small numbers. The dog was alive and apparently in good health on the 115th day.

Two monkeys were successfully inoculated from the original guinea-pig. The infection was very chronic and the monkeys were still alive and apparently well on the 118th and 137th days.

One of two goats inoculated became infected. Trypanosomes were found to be very scantily present on two occasions only.

The evidence is said to be in favour of this trypanosome being a new species.

(249) Delanoë (P.). **Des Variations du Pouvoir Infectieux et de la Virulence de *Trypan. dimorphon* L. et M. (suite). Deuxième Note.** [Variations in the Infectivity aud Virulence of *Trypanosoma dimorphon* L. and M. Second Note.]—*Bull. Soc. Path. Exot.* 1914. Apr. Vol. 7. No. 4. pp. 281-289.

(For abstract of the Preliminary Note, see this *Bulletin*, Vol. 2, No. 1. p. 68.)

In this paper the author gives at length a description of the experiments carried out with a strain of *T. dimorphon* derived from a naturally infected ox, which at the outset was not inoculable for the white rat and the guinea-pig, and which after a series of experiments became pathogenic for both of these species and capable of causing a fatal infection in the former. The experiments do not as yet warrant any statement as to whether the trypanosome is fatal for the guinea-pig.

The strain acquired the power of infecting the rat after one passage through a kid and one through a dog. The strain became pathogenic for the rat after the first passage through the rat.

The author also found that when, after inoculation with the trypanosome, there was no blood invasion, the animal acquired no immunity.

The strain became infective for the guinea-pig after the following passages: one through a kid, followed by one through a dog, a second through a kid and one through a white rat.

The conclusion drawn is that it is difficult to demonstrate the susceptibility of the white rat and the guinea-pig to *T. dimorphon*, and that a trypanosome can be said to be non-pathogenic for a particular species only after repeated and varied experiments.

(250) KLEINE (F. K.), FISCHER (W.) & ECKARD (B.). **Ueber die Bedeutung der Speicheldrüseninfektion bei der Schlafkrankheitsfliege (*Glossina palpalis*). II Mitteilung.** [The significance of the Infection of the Salivary Glands in *Glossina palpalis*. Second Part.]—*Zeitschr. f. Hyg. u. Infektionskr.* 1914. May 27. Vol. 77. No. 3. pp. 495-500.

An abstract of the first communication on this subject will be found on page 282 of Volume 1 of this *Bulletin*.

In this paper the authors detail some experiments regarding the path by which trypanosomes (*T. gambiense*) reach the salivary glands.

The possibility was considered that it might be from the body cavity. Laboratory-bred flies were given four feeds upon monkeys infected either with *T. gambiense* or *T. rhodesiense* and were then fed upon healthy monkeys until these were found to be infected. The whole batch of flies used in the particular experiment were then killed by chloroform.

In order to obtain fluid from the body cavity two methods were adopted. In the majority of cases the legs were cut off close to the thorax, and the liquid made to exude from the abdominal and thoracic cavities by slight pressure upon the wounds with a slide. In the other cases a transverse slit was made about the middle of the under surface of the abdomen, and from this a cut was made upwards. The exuding liquid was collected in a capillary pipette, films being subsequently made from it.

In 21 experiments 215 flies were used, and of these at least 21 actually became infected.

A further batch of 207 flies which had had a single meal on an infected monkey and were then fed upon healthy animals were examined, but in this case the question of the infectivity of the flies was not actually determined.

In no cases were any trypanosomes found in the fluid obtained from the body cavities, although in the second batch of flies eleven were found to have numerous trypanosomes in their intestines, and were consequently on the way to becoming infective, if not actually so.

Previously to carrying out the experiments mentioned the authors had examined the fluid from the body cavities of nine infected flies and in three instances had discovered trypanosomes. They, however, believe that these discoveries were probably due to faulty technique.

(251) HAGEMEISTER (Wolfgang). **Ueber die Zuchtung pathogener Trypanosomen auf künstlichen Nährböden.** [The Cultivation of Pathogenic Trypanosomes in Artificial Media.]—*Zeitschr. f. Hyg. u. Infektionskr.* 1914. Apr. 1. Vol. 77. No. 2. pp. 227-256.

The medium used by the author in his later experiments was as follows :—

Extract of 125 gm. of beef or horse flesh in 1000 cc. of distilled water.
20 gm. of agar.
20 gm. of peptone.
5 gm. of sodium chloride.

The reaction of the medium was neutralised and 5 cc. of normal soda solution added in excess. There was also added 2 per cent.

of dextrose on the lines recommended for the cultivation of malarial parasites and piroplasms.

To this medium two or three times the volume of sterile defibrinated blood was added. It was found that the addition of dextrose obviated the necessity of using rabbit blood, this being replaced successfully by goat, horse, donkey, and calf blood. The tubes were sealed with paraffin wax.

The trypanosomes used were the " Ferox " stain of nagana and the Eastern Prussian strain of *T. equiperdum*.

The seed material for the cultures consisted of heart blood of rats and mice which had been inoculated intraperitoneally. The blood was drawn from the still beating hearts of heavily infected animals into capillary tubes containing salt solution. Two or three drops of this mixture were used for the inoculation of each tube. The tubes were kept in the dark at room temperature.

Experiments were first made with the trypanosome of the *theileri* type occurring in cattle in Germany. It was found possible to obtain growths in those tubes only which contained ox blood and were incubated. Only 50 per cent. of these tubes shewed any growth, and in these there was active growth from the fifth day onwards. Trypanosomes began to decrease in numbers from the twelfth day and had disappeared by the eighteenth day. Sub-cultures were obtained in tubes of medium containing goat blood.

With the *T. brucei* the author was never able to find trypanosomes in his cultures after the eleventh day, and in no case were they numerous. There were no rosettes formed. A series of tubes to which goat blood was added succeeded in only 20 per cent. and in these trypanosomes were visible for four days only.

Parallel series of tests were made, and it was found that the tubes containing bloods other than rabbit blood and to which dextrose had been added yielded better results than the Novy medium as originally described.

The addition of dextrose to media containing rabbit blood did not improve them.

Conclusions:

Multiplication of ox trypanosomes of the *T. theileri* type on media containing ox blood and incubated at 37° C. occurs in the first generation only. But subcultivation succeeded with trypanosomes of this species when media containing goat blood were used.

The addition of dextrose has a beneficial effect upon the vitality of the trypanosomes and upon their capacity for multiplying in vitro.

The addition of dextrose to other kinds of blood (goat, horse, donkey, calf) not only replaced the expensive rabbit blood, but actually rendered them superior to it. Dextrose did not exert any beneficial effect upon media containing rabbit blood.

Trypanosomes cultivated upon media containing dextrose retained their infectivity, but lost their virulence to some extent.

A number of passages through cultures does not render the pathogenic trypanosomes more suitable for cultivation in vitro, but their vitality is thereby decreased and their virulence is rapidly diminished.

T. brucei retains its virulence in cultures better and with more regularity than *T. equiperdum*.

(252) PRINGAULT (E.). *Cimex pipistrelli*, **Jen., Agent de la Transmission de la Trypanosomiase des Chauves-souris.** [*Cimex pipistrelli*, Jen., the Transmitting Agent of Trypanosomiasis in Bats.]—*Compt. Rend. Soc. Biol.* 1914. June 5. Vol. 76. No. 19. pp. 881-883.

The author has carried out experiments indicating that bugs act as the transmitting agent of *Trypanosoma vespertilionis*.

(253) PRINGAULT (E.). **Non-pathogenicité du *Trypanosoma vespertilionis* (Battaglia) pour les Animaux de Laboratoire.** [The Non-Pathogenicity of *T. vespertilionis* for Laboratory Animals.]—*Compt. Rend. Soc. Biol.* 1914. June 5. Vol. 76. No. 19. pp. 883-884.

The author is in agreement with SERGENT, NICOLLE, and COMTE in finding this trypanosome non-pathogenic for laboratory animals, and disagrees with BATTAGLIA, who successfully infected guinea-pigs and rabbits.

(254) MAYER (M.) & DA ROCHA-LIMA (H.). **Zum Verhalten von *Schizotrypanum cruzi* in Warmblütern und Arthropoden.** [*Schizotrypanum cruzi* in Warm-blooded Animals and Arthropods.]—*Arch f. Schiffs- u. Trop.-Hyg.* 1914. Beiheft 5. Vol. 18. pp. 101-136. With 2 coloured plates.

Summary.

1. A description is given of the course of the infection when passed through monkeys, guinea-pigs and mice, and particular interest attaches to the occurrence of relapses after long periods (in one case after eight months in the guinea-pig).

2. In most cases recovery renders rats, rabbits, and guinea-pigs resistant to re-infection. The serum of such immune animals was found to have no therapeutic effect when injected 24 hours before and simultaneously with infective material.

3. Complement-fixation experiments with serum and extracts of organs from infected animals did not give any results different from those given by controls.

4. Dividing forms, save those already described by CHAGAS, in which nuclear division was just commencing, were never seen in the peripheral blood. Leishmanial forms were frequently observed.

5. Examination of sections shewed that the Schizotrypanum multiplies by division within the tissue cells, the parasites being rounded or spindle shaped as a result of pressure, and that the size and form of the parasite is retained during multiplication. Finally small individuals are produced at the last division which rapidly develop into trypanosomes. These leave the host cell after a short time (the time varying with the tissue) and invade the blood stream.

6. The normal development of the Schizotrypanum within the tissue cells does not appear to injure these in any way. Even the mechanical effects produced by large groups of parasites are rapidly and completely repaired, at least in muscle fibres. Toxic substances appear to be produced when the parasites are injured in any way. Altered host cells may contain parasites which have abnormal morphological and developmental features. There is no direct connection apparently between the formation of a colony of parasites in organs and symptoms of general degeneration or disturbance of function. A causal connection is only established when parasites are destroyed in large numbers. In such cases there may be destruction of the host cells and not infrequently evidence of wide-spread inflammatory changes. There is therefore no basis for explaining clinical symptoms and anatomical alterations on the grounds of the discovery of uninjured developing parasites.

7. Animals of the same kind, infected in the same manner, and shewing the same clinical picture, shew on microscopic examination of their organs the widest differences in the extent and severity of the lesions and in the distribution of the parasite. The most severe lesions are generally found in the stripped muscular tissue. The fatty tissue was frequently the seat of extensive degeneration. The other organs, although they frequently contained colonies of parasites, in most cases shewed no lesions.

8. The development of the parasite in *Conorhinus megistus*, *Acanthia lectularia* and *Ornithodorus moubata* was followed more closely. Transmission by biting was not determined with certainty in a large number of series (two doubtful positive results). The ingestion of infected ticks by mice and the bites of such ticks in no case caused infection.

9. No development occurred in *Stegomyia calopus* and *Culex pipiens*.

10. Experiments with the various "trypanotropic" drugs have yielded only unsatisfactory results up to the present.

(255) Blacklock (B.). **The Multiplication and Infectivity of *T. cruzi* in *Cimex lectularius*.**—*Brit. Med. Jl.* 1914. Apr. 25. No. 2782. pp. 912-913

The experiments described were undertaken in order to ascertain whether *T. cruzi* is capable of existing and developing in *Cimex lectularius*, and if so, whether the forms found in the bed bug are capable of infecting laboratory animals when injected into them, or when the bugs feed on the animals.

Conclusions :—

"1. *T. cruzi* is capable of living and multiplying in *Cimex lectularius* for long periods.

"2. The parasites found in the bed bug are infective on inoculation as early as 21 hours and as late as 77 days from the infecting feed.

"3. It is not possible to say which of the many different forms occurring in the bug causes infection in the vertebrate host.

"4. Transmission of the disease to healthy animals by feeding infected bugs on them is of very rare occurrence. It was only once observed in the course of these experiments.

"5. There is no evidence of the hereditary transmission of *T. cruzi* in *Cimex lectularius*."

LEISHMANIASIS.

(256) Caronia & di Giorgio (G.). **Sulla Leishmaniosi spontanea nei Cani di Palermo.** [Spontaneous Canine Leishmaniasis in Palermo.] —*Pathologica.* 1914. Apr. 15. Vol. 6. No. 131. pp. 208-209.

This brief paper gives the results of the examinations carried out on dogs during the twelve months ending August, 1913. One thousand and five dogs were examined and only one was found to be infected.

(257) Pittaluga (G.). **Kala Azar Infantile e Leishmaniosi canina in Ispagna.** [Infantile Kala Azar and Canine Leishmaniasis in Spain.] —*Pathologica.* 1914. Mar. 1. Vol. 6. No. 128. pp. 121-123.

The author records the discovery of two cases of spontaneous canine leishmaniasis at Tortosa, and one at Beninar, in Almeria. Cultures were successfully made.

(258) da Silva (P.). **Notes sur le Kala Azar.** [Notes on Kala Azar.] —*Arquiv. do Instit. Bact. Camara Pestana.* 1914. June. Vol. 4. No. 2. pp. 147-172. With 2 plates and 3 text figs.

During the period May, 1910, to March, 1911, 300 dogs were examined and eight were found to be infected with Leishmania. The spleen, bone marrow, and liver were examined. Subsequently seven other dogs were examined, and one found infected.

During the period March to June 1912, a fresh series of examinations was made and four infected dogs were found among 109 examined. In these instances only the spleen was examined.

Details are given of 12 dogs which were used for experimental inoculations, the virus in one experiment having been obtained in the first instance from a case of the disease occurring in a human being (a girl of nine years of age). In other cases the infection was transmitted by inoculation from a naturally infected dog to others.

In experimentally infected dogs no symptoms are said to be observed. A diagnosis must be based upon the detection of the parasite in the liver or in the bone marrow. It is difficult or impossible to locate the spleen by palpation and therefore spleen puncture was not resorted to. The author prefers the examination of bone marrow to that of material obtained by liver puncture as being more certain.

Cultivation upon NNN medium is more certain than microscopic examination for the detection of the parasite.

The belief is stated that the skin lesions that have been described as occurring in cases of canine leishmaniasis are due to follicular mange and not to the leishmaniasis.

It was found to be possible to transmit both the human and canine strains to dogs by inoculation.

In the author's opinion only two of the experimentally infected dogs actually died of the disease, death in other instances being due to follicular mange.

A number of experiments have been carried out regarding the transmission of leishmaniasis with fleas, both *Pulex irritans* and *Ctenocephalus canis*, and, though very definite results have not been obtained, the author appears to incline to the view that fleas play a part in the transmission.

(259) PRINGAULT (E.). **La Leishmaniose canine à Marseille.** [Canine Leishmaniasis at Marseilles.]—*Bull. Soc. Path. Exot.* 1914. June. Vol. 7. No. 6. pp. 484-488.

During the period December to May the author has examined 310 dogs of various species and has found five infected with Leishmania. He gives his reasons for believing that these dogs have not been imported from places where canine leishmaniasis exists, and re-affirms his statement that canine leishmaniasis actually occurs at Marseilles.

(260) NICOLLE (C.) & CONOR (Marthe). **Difficulté de Conservation du Virus de la Leishmaniose Canine par les Passages.** [The Difficulty of preserving the Virus of Canine Leishmaniasis by Passage.]—*Bull. Soc. Path. Exot.* 1914. June. Vol. 7. No. 6. pp. 481-484.

The authors referred to this difficulty in 1912 [see this *Bulletin*, Vol. 1, pp. 109–110], and the present paper contains a detailed description of a fresh series of experiments of the same nature as those originally described.

The following is a summary of the results obtained :—

At the first passage two dogs out of three were certainly infected, and three monkeys out of four were probably infected.

At the second passage one monkey out of four became infected, but the inoculation failed in the case of three dogs.

At the third passage two mice and one of two monkeys became infected.

At the fourth passage three monkeys and two mice were inoculated without success.

The canine virus appears to be more difficult to maintain by passage than the human virus, and it is a curious fact that the virus isolated from a naturally infected dog appears to be less virulent for the dog than the human strain.

The impossibility of protecting dogs from infection with piroplasmosis in Tunis increases the difficulties of maintaining the virus.

(261) NICOLLE (C.). **Chronique du Kala Azar en Tunisie.** [Kala Azar in Tunis.]—*Bull. Soc. Path. Exot.* 1914. June. Vol. 7. No. 6. pp. 479-481.

Since the publication of statistics in the Archives of the Pasteur Institute, Tunis, in 1912, eight additional cases of the disease have been observed in the human subject, making 38 cases in all. In addition, there has been one case recorded in a child in Algeria. All the cases save one occurred in children under three years of age, and six were in boys.

During 1913, 109 dogs were examined. The animals were principally selected from among animals whose appearance raised the suspicion that they might be infected. Six cases were detected, four severe and two moderate.

During September 20 cats were examined, but with negative results in every case.

Five strains of parasites are kept in artificial culture; two from cases of kala azar, two from naturally infected dogs, and one from a case of oriental sore. NNN medium is used, and subcultures are made twice monthly. The parasites have been maintained without morphological alteration through from 56 to 119 generations.

All the cultures grow easily and form little transparent colonies on the surface of the blood-agar.

The authors draw attention to the occurrence of splenic anaemia in children only a few months old, the cause of which has not been determined.

(262) Row (R.). **Generalised Leishmaniasis induced in a Mouse with the Culture of *Leishmania tropica* of Oriental sore.**—*Bull. Soc. Path. Exot.* 1914. Apr. Vol. 7. No. 4. pp. 272-277.

The author has succeeded in producing a generalised infection by inoculating a mouse intraperitoneally with cultures of *L. tropica*. Three inoculations were given on three successive days, using cultures varying from four to seven weeks old, and a final inoculation was given two months later. The mouse was killed nine months after the final inoculation. The spleen was six to eight times the normal size, and the liver was distinctly enlarged. The peritoneum appeared to be normal. The parasites were present in large numbers in the spleen, liver, and bone marrow, and cultures were raised from them. Films of the heart blood showed "large cocci-like dots occupying apparently the red cells singly." That these bodies were not cocci was shown by the fact that they could not be cultivated upon agar.

This appears to furnish evidence that *L. tropica* and *L. donovani* may be identical, in spite of the different clinical aspects of oriental sore and kala azar.

(263) Wenyon (C. M.). **Demonstration by Dr C. M. Wenyon of some smears made by** Dr. Neligan **from Oriental Sore in Dogs in Teheran, Persia.**—*Trans. Soc. Trop. Med. & Hyg.* 1914. June. Vol. 7. No. 6. pp. 215-216.

"Dr. C. M. Wenyon showed some specimens, under the microscope, of smears made by Dr. Neligan from oriental sore in dogs, in Teheran, Persia, and made the following statement with regard to them:—

"Dr. Neligan, who was the first to demonstrate leishmania in the skin lesions of dogs, tells me that oriental sore is very common, both in human beings and in dogs, in Teheran. Dr. Neligan's discovery of oriental sore in dogs is of much interest in that it places this disease on the same footing as kala-azar, which is known to occur naturally both in human beings and dogs. A further observation which Dr. Neligan has made is that leishmania not only occur in the sores about the heads of the dogs, but that they also occur in the internal organs. Dr. Neligan has sent me smears of the organs of dogs which had oriental sore and in the bone marrow fair numbers of leishmania occur. Here is a difficult question to settle. Does the presence of leishmania in the organs mean that the dogs are suffering from a general infection with *Leishmania tropica*, the parasite of oriental sore, or does it mean that in Teheran there occurs also canine kala-azar, and that the dogs with the general infection, as well as the local skin lesions, are suffering from both diseases, oriental sore and kala-azar? A mere examination of the films cannot answer this question, which can only be settled on the spot by further observations and experimental work."

SPIROCHAETOSIS.

(264) MACFIE (J. W. Scott) & JOHNSTON (J. E. L.). **A Note on the Occurrence of Spirochaetosis of Fowls in Southern Nigeria.**—*Ann. Trop. Med. & Parasitol.* 1914. Apr. Vol. 8. No. 1. pp. 41-45. With 2 plates.

The disease, which is well-known among the natives, was first brought to the notice of the authors as occurring in Muscovy ducks, but subsequently it spread to the fowls in the same compounds.

The symptoms were those usually observed in spirochaetosis. On post-mortem the liver and spleen were found to be greatly enlarged, the former containing necrotic patches of considerable size.

The parasite appeared to resemble very closely that described by BALFOUR as occurring in the Soudan.

Atoxyl and salvarsan were tried in a very small number of cases and the results appeared to indicate that salvarsan would yield the better results.

The authors were unable to convince themselves of the presence of "after phase" bodies described by BALFOUR, and had no opportunity to carry out any immunity tests with the object of determining the identity of the parasite.

(265) LAUNOY (L.) & LÉVY-BRUHL (M.). **Le Sang de la Poule dans la Spirillose expérimentale.** [The Blood of the Fowl in Experimental Spirillosis.]—*Ann. Inst. Past.* 1914. May. Vol. 28. No. 5. pp. 517-539. With one coloured plate.

Conclusions :—

1. Infection of adult fowls with *Spirochaeta gallinarum* sets up a very marked and rapid anaemia, the number of blood corpuscles being in some cases reduced to half the normal in five days. This phenomenon is the most characteristic from the haematological point of view. The intensity of the anaemia and some of the characters possessed by it cause spirillosis to resemble the so-called pernicious anaemias. But this disease differs from the pernicious anaemias in that there is a rapid and complete regeneration of the blood within a fortnight after the crisis.

2. The anaemia and the regeneration of the blood are accompanied by variations in the leucocytes which follow a constant cycle.

Day of Disease.	Clinical.	Red Corpuscles.	White Corpuscles.
1 to 2	Incubation ..	Commencing anaemia	Leucocytosis with polynuclears having rod-shaped granules.
3 to 5	During attack	Progressive destruction	Leucocytosis with neopolynuclears.
5 to 6	Crisis	Maximum anaemia ..	Leucopenia.
6 to 10	Convalescence	Regeneration.	Mononuclear leucocytosis.
,,	Recovery	Normal.	Normal, slight leucocytosis or sometimes prolonged mononuclear leucocytosis.

3. The spleen appears to play no part in these modifications in the blood. Splenectomy does not influence the series of changes indicated in the table.

(266) BRONFENBRENNER (J.). **A Simplified Method for Cultivating Spirochaetes on Liquid Media.**—*Proc. Soc. Exp. Biol. & Med.* 1914. June. Vol. 11. No. 6. pp. 185-187. With 1 text fig.

The method described is a modification of NOGUCHI's method, and was devised in order to obviate the use of a rubber stopper connection between the upper and lower parts of the apparatus, as this often becomes a source of contamination of the culture.

The new method may be used in two ways :—

1. A single tube replaces the two tubes joined by a rubber bung in NOGUCHI's method. A piece of rabbit kidney is placed in the bottom of the tube, which is then drawn out at about its middle point to form a constriction. It is then filled with ascitic broth or sheep serum water to the point where the tube broadens out again above the constriction. Another piece of tissue is placed in the upper portion of the tube and this is filled with ascitic agar, preferably 1 per cent. In this the spirochaete culture is placed. Sterile paraffin oil in a thin layer is then placed above the agar and the tube incubated.

2. A better way is as follows: A piece of tissue is placed in the bottom of a tube, which is then drawn out as before. By means of a capillary pipette the spirochaete culture and ascitic broth are introduced into the bottom of the tube. A bung is fitted into the mouth of the tube, through which passes a glass tube shaped like the letter Y, with the two upper arms projecting freely. One of these is connected to an exhaust pump and the other to a reservoir of sterile paraffin oil. The tube is exhausted by the pump, the tube being immersed in water at 37° C. to facilitate the exhaustion. After exhaustion, the cock below the oil reservoir is opened and the oil is allowed to run down on to the surface of the medium, the negative pressure in the tube assisting this. The tube is then sealed off at the constriction. It is said that the oil makes it possible to keep the spirochaetes alive after the tube is once opened. The author has kept his cultures going in this way for three months.

MALARIA AND MISCELLANEOUS HAEMO-PARASITES.

(267) SEIDELIN (H.) & CONNAL (A.). **A Note upon the Occurrence of a Plasmodium in the Blood of West African Monkeys.**—*Ann. Trop. Med. & Parasit.* 1914. Apr. 21. Vol. 8. No. 1. pp. 81-82.

The authors have discovered parasites belonging to the genus Plasmodium in each of three young monkeys examined at the Medical Research Institute at Yaba, near Lagos. Two of the monkeys were *Papio sphinx*, and the other was a *Cercopithecus mona*. The parasites were very scantily present, but in two of them both gametocytes and schizonts were seen.

The following characters were observed: The pigment in fresh preparations was of a bright yellow colour, and in preparations stained with Giemsa it took on a brilliant green tint. The chromatin was looser in texture and stained more faintly than the chromatin in parasites of the human subject. The cytoplasm, and particularly that of the microgametocytes, stained very faintly.

Particular interest lies in the fact that only three monkeys were received and all were found to be infected.

(268) SERGENT (Ed.) & BÉGUET (M.). **De l'Immunité dans le Paludisme des Oiseaux. Les pigeons guéris de l'Infection à *Haemoproteus columbae* ne sont pas immunisés contre elle.** [Immunity in Avian Malaria. Pigeons which have recovered from Infection with *Haemoproteus columbae* have not acquired Immunity against it.] —*Compt. Rend. Soc. Biol.* 1914. June 12. Vol. 77. No. 20. pp. 21-23.

The authors find that in those rare cases in which recovery takes place rapidly no degree of immunity is acquired; but in those more usual cases in which recovery is not complete, parasites remaining in the blood for long periods, this latent infection corresponds to a condition of relative immunity. In the event of complete recovery taking place this relative immunity is lost.

(269) ROWLEY-LAWSON (Mary). **Free Malarial Parasites and the Effect of the Migration of the Parasites of Tertian Malarial Infections.**— *Jl. Exp. Med.* 1914. June. Vol. 19. No. 6. pp. 523-535. With 6 plates (one in colour).

"1. The malarial parasite is extracellular throughout its life-cycle and migrates from red corpuscle to red corpuscle destroying each before it abandons it; in the brief intervals between, the parasite is free in the blood serum; it does not remain long free, but almost immediately attaches itself to another red corpuscle by means of delicate pseudopodia.

"2. The compact form of the tertian parasite is the type of free parasite most often observed; in this form the parasite may be seen not only in migration, but after quinine and in the cadaver. I believe the compact form to be the normal resting form of the parasite, all other forms being assumed in order to secure attachment and to obtain food.

"3. Care must be taken not to confound free parasites having protoplasmic pseudopodia ready for attachment with the sexual flagellating parasites, whose flagella are composed of chromatin.

"4. The malarial parasite can live for some time free in the blood serum, though under normal conditions there is no reason why it should remain free for any length of time, and there are certain periods in the life of the parasite when it must be admitted that it is free from the corpuscle and survives. If the parasite is, as I believe, attached to the external surface of the red corpuscle, it is constantly exposed to the action of the patient's serum.

"5. The destruction of more than one red corpuscle by each parasite would readily account for the severe and early anaemia occurring in malarial infections."

"6. Long continued treatment with quinine will eventually cause the death of all malarial parasites."

(270) Rowley-Lawson (Mary). **A Stage in the Migration of the Adult Tertian Malarial Parasite. Evidence of the Extracellular Relation of the Parasite to the Red Corpuscle.**—*Jl. Exp. Med.* 1914. May. Vol. 19. No. 5. pp. 450-458. With 5 plates (one in colour.)

The author recapitulates her views regarding the extra-cellular position of the malarial parasite and its migrations from corpuscle to corpuscle, and in the present paper refers particularly to that stage in which pigmented parasites are found partly on and partly off degenerated red corpuscles, caught apparently in the act of leaving them.

" 1. What appear to be certain definite stages in the migration of the malarial parasite from red corpuscle to red corpuscle may be demonstrated by thorough and persistent observations, not minutes spent on each specimen, but many hours.

" 2. The migration of the malarial parasite from red corpuscle to red corpuscle gives a reasonable explanation of the loss of red corpuscles which cannot be accounted for by the destruction of the infected corpuscles at the time the parasites segment.

" 3. Migration to other red corpuscles is a satisfactory explanation of the ultimate fate of the young parasites seen in instances of multiple infection of single corpuscles.

" 4. In the light of the facts here presented, it would seem impossible to explain the instances of the parasites partly on and partly off degenerated red corpuscles as the result of technique. A stage in the migration of the parasite seems to me to be the probable interpretation of the phenomenon.

" 5. A corpuscular mound encircled by an adult parasite, when seen at the periphery of the red corpuscle, should have the same significance and interpretation, in reference to the extracellular relation of the parasite to the corpuscle, that it has when it is seen in connection with a young parasite.

" 6. The adult ring-form parasite should have the same interpretation as the young ring-form parasite.

" 7. Attachment to the external surface of the red corpuscles seems to me to be the only possible interpretation of the appearances of the parasites pictured in this article."

(271) Fletcher (W.). **The Wassermann Reaction in Malaria.**—*Lancet.* 1914. June 13. pp. 1677-1678.

Conclusion: The presence of malarial parasites in the blood does not cause the serum to give a positive Wassermann reaction when the method of Browning, Cruikshank, and McKenzie is employed.

(272) Nawrotzky (N. N.). **Haematoparasitologische Notizen. Zweite Mitteilung.** [Notes on Blood Parasites. Second Part.]—*Centralbl. f. Bakt.* 1 Abt. Orig. 1914. Apr. 25. Vol. 73. No. 6. pp. 358-362. With 1 plate comprising 14 figures in colour.

This paper deals with the following parasites: The trypanosome of the pike, the trypanoplasma of the pike, a haemogregarine of the pike (new species), haemogregarine of the sterlet (new species), filaria of the white heron (new species), and the microfilaria of the rook.

(273) Ringenbach (J.). **Quelques Hematozoaires du Congo.** [Some Haematozoa from the Congo.]—*Bull. Soc. Path. Exot.* 1914. Apr. Vol. 7. No. 4. pp. 296-299.

The author has discovered a trypanosome in the blood of the

hornbill, *Bycanistes albotibialis*, commonly known as the Calao, which is possibly different from the parasites described by a number of other authors. But, as the authors point out, morphological differences are not always sufficient to establish a species.

The trypanosome had the following average measurements :—

Total length	53 microns.
Maximum width	8 „
Distance from the centrosome to the posterior extremity	5·7 „
Distance from the centrosome to the anterior edge of the nucleus	14·3 „
Larger diameter of the nucleus	4·2 „
Free portion of the flagellum	8 „

A microfilaria has been found in the blood of the same bird. The parasite was 234 microns in length by 3 in width. In the fresh state it was very actively motile. There was no sheath. The body tapered towards the posterior extremity, which was bluntly rounded. The parasite appears to be distinct from those described by LEGER as occurring in various hornbills in the Soudan. The author proposes the name *Microfilaria bycanisti*.

A microfilaria has also been found in the blood of the Touraco (*Schizorhis cristata*). In the fresh state this parasite moves very slowly. It is provided with an envelope which scarcely exceeds the parasite in length. The body measures 127 microns in length by 3·7 in width; the sheath is about three times the width (10 microns). The name *Microfilaria schizorhinos* is suggested, as the author is unable to say whether the parasite is identical with that which PLIMMER found, but did not describe, in two touracos in West Africa.

The author has found parasites resembling the microgametocytes of *Plasmodium kochi* in the blood of a *Cercopithecus cephus*.

TSETSE FLIES.

(274) LLOYD (Ll.). **Note on Scratching Birds and Tsetse-fly.**—*Ann. Trop. Med. & Parasit.* 1914. Apr. 21. Vol. 8. No. 1. p. 83.

The suggestion has been made from time to time that guinea-fowl might, among other birds, act as a control to Glossina by ingesting the pupae, and the value of this suggestion has been tested by the author by the examination of the contents of the crops of ten guinea-fowl at Nawalia in the Luangwa Valley.

The birds are very numerous in Northern Rhodesia and especially in the Luangwa Valley.

In only three were any insects found, and in these they were very scantily present. No pupae of any kind were recorded. It appears that the bird is a vegetable feeder, and only eats insects when searching for food. The pupae of *G. morsitans* are usually placed in positions that are inaccessible to these birds, and therefore the guinea-fowl cannot be considered as suitable to act as a control of the fly.

(275) SHIRCORE (J. C.). **Suggestions for the Limitation and Destruction of *Glossina morsitans*.—*Bull. Entom. Res.* 1914. Apr. Vol 5. No. 1. pp. 87-90. With 1 map.**

The author's observation leads him to conclude that in the "proclaimed area" there are at least four "primary centres" which harbour tsetse flies.

These areas are defined as "primary centres" for the following reasons.—Flies are found abundantly in these centres throughout the year, even when there are none or very few elsewhere. These are the only areas in which during the dry season there is water above or at a slight depth below the surface of the earth. These situations offer the best chance of feeding for the flies during the drought, as they are frequented by various species of game. The conditions, viz., light forest with open glades, short grass and water close at hand, form an ideal combination for both game and fly.

The probability is that the flies breed in these areas and from them spread to the surrounding country when the conditions become favourable. This spreading has been observed, and it has also been observed that "secondary centres" are formed with the onset of the rains, a different type of country being then more suitable.

The author advises that the forest connections along which these radiations take place should be cut off or otherwise dealt with about May, so that the "primary centres," which should have been delimited at the height of the previous dry season, may be isolated. The trees in the areas should then be cut down and left to dry, extensive burning of the areas being practised when the drying is complete.

(276) ZUPITZA (M.). **Versuche und Vorschläge zur Verbesserung von Glossinenfangmethoden.** [Experiments and Suggestions for the Improvement of Methods for Catching Tsetse Flies.]—*Arch. f. Schiffs. u. Trop.-Hyg.* 1914. June. Vol. 18. No. 11. pp. 363-375. With 2 figures.

The author is of the opinion that the limed cloths used by CLEVE fail in their object to a great extent because they do not allow the passage through them of the scent of the man or animal upon which they are placed. To avoid this objection he used sheets of wire gauze with a mesh of about 2 centimetres. He found, however, that this was too large a mesh, and therefore used two layers of the gauze, one over the other. The gauze was hung in front and behind after the manner of sandwich boards, and the straps were so constructed that the gauze could be taken off for the purpose of removing flies adherent to it.

The lime used smelt of resin, and had a honey-like consistence and colour. During the warm periods of the day it became very fluid and had to be renewed every two hours. It was easily soluble in spirit, but not in pure water.

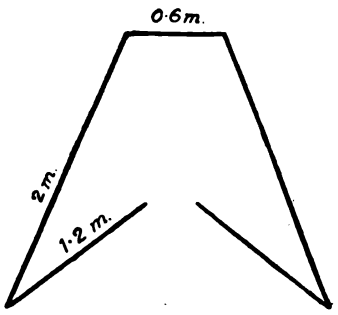
A comparison is made between the number of flies caught by means of this apparatus and the number caught during the same periods and at the same places with a net. This indicates that the butterfly net is slightly superior as a means of catching the flies.

Improvements are suggested in the manner of carrying the wire, mesh coverings. In order to completely cover the body it is suggested that a slightly flattened cylinder of the gauze would be the best. The gauze should be made of iron wire about 2 mm. thick, and should have a mesh of about 1 centimetre. Porous material of a rather dark colour should be worn underneath the gauze, and specially stout material should be used for covering the arms and legs.

The author also describes a fly trap with which no lime is used.

The trap consists of a cage, which in section is described as being shaped like an arrow-head with the point cut off. The depth of the trap from before to behind is about 2 metres. The side opposite that representing the truncated point of the arrow is composed of two doors opening inwards and leaving between them a narrow opening. The flycatcher is placed inside the trap. Flies coming in contact with the sides of the trap eventually find their way in and are caught. The trap itself consists of a framework covered with a thick muslin.

The diagram shows the plan of the trap with measurements.



(277) Simpson (J. J.). **Entomological Research in British West Africa. V. Gold Coast.**—*Bull. Entom. Res.* 1914. Apr. Vol. 5. No. 1. pp. 1-36. With 4 plates and 1 map.

This paper deals mainly with the distribution of various blood-sucking insects, but information is also given regarding the following points:—The position, configuration, and vegetation of the colony, climate and rainfall, insect-borne diseases in man and other animals, distribution of the genus Glossina, and parasites of mammals.

With regard to the diseases of animals, it is said that very few cattle are bred in the colony, but that 80 per cent. of the animals brought down from the north for slaughter at Coomassie are infected with trypanosomes. Only *T. cazalboui* and *T. pecaudi* have been found in cattle. Beal states that these two with *T. dimorphon* are equally prevalent in horses. *T. dimorphon* alone has been found in dogs. Two sheep out of 83 examined have been found infected with trypanosomes similar to those occurring in cattle. Only one case of trypanosomiasis has been observed in the goat, and none in the pig.

Two cases of spirochaetosis have been recorded in the sheep and one in the goat by O'Brien.

Blood smears from eleven different kinds of game were examined for parasites, but none were found.

HELMINTHS.

(278) Railliet (A.), Henry (A.) & Bauche (J.). **Sur les Amphistomiens des Ruminants domestiques de l'Annam.** [The Amphistomes of Domestic Ruminants in Annam.]—*Recueil Med. Vet.* 1914. May 30. Vol. 91. No. 10. pp. 195-201.

In cattle slaughtered at Hue amphistomes are found most frequently in the rumen, but they also occur in the reticulum, abomasum, and bile ducts. A number of different species have been found.

In the buffalo the following parasites have been found in the rumen : *Gastrothylax cobboldi*, *G. elongatus*, *G. minutus*, *Paramphistomum orthocoelium*, and *P. papillosum*. In the ox, *Gastrothylax crumenifer* has been found.

G. elongatus has been found in the reticulum of the buffalo only.

Paramphistomum bathycotyle, *Cotylophoron cotylophorum*, and *Homalogaster paloniae* have been found in the abomasum of the buffalo, ox and sheep respectively.

Paramphistomum explanatum has been found in the bile ducts of the buffalo.

The authors think that *Paramphistomum fraternum*, Stiles and Goldberger, 1910, is synonymous with *P. explanatum*.

They are further of the opinoin that *H. poirieri*, Giard and Billet, 1892, and *H. philippinensis*, Stiles and Goldberger, 1908, are in reality identical with *H. paloniae*.

The question of the pathogenic rôle played by amphistomes is considered, and the authors state that by means of the phenolthalein test they have been able to detect the presence of blood in the bodies of *G. elongatus* and *crumenifer*, and have obtained doubtful results with *G. cobboldi* and *minutus*. Some evidence has been obtained that the ventral pouch of the parasites contains sanguinolent liquid. The question as to how this liquid gains access to the pouch is interesting, because it is known that neither the mouth nor the orifice of the ventral pouch is provided with an armature for penetrating the mucous membrane, nor has any lesion of the mucous membrane ever been described. The suggestion is made that the examination of parasites *in situ* in animals freshly slaughtered also throws some light upon the question of the nutrition of the parasites.

(279) Seurat (L. G.). **Sur un Nématode parasite du Flammant rose.** [A Nematode Parasite of the red Flamingo.]—*Compt. Rend. Soc. Biol.* 1914. May 22. Vol. 76. No. 17. pp. 814–817. With 4 text figs.

Fifteen specimens of a female Tropidocerca were found by the author in the gastric glands of two flamingoes killed in Algeria. Owing to the bright red colour, the name *Tropidocerca coccinea* is suggested.

Female.—Practically the whole of the body consists of a red globular structure measuring about 2·5 millimetres in diameter. Laterally, dorsally, and ventrally there are longitudinal bands of muscle fibres. These longitudinal bands are connected by circular strands which produce an appearance of transverse striation.

This globular portion of the body in reality represents only the middle part, greatly distended owing to the exaggerated development of the intestine and uterus. Anteriorly the body is continued in the

form of a pointed projection comprising the oesophageal and cephalic portions. Posteriorly there is a conical tail, and the anus is situated a little in front of the extremity.

The buccal cavity is rounded and measures about 20 microns. The oesophagus is encircled at its middle point by the nerve ring. The muscular portion of the oesophagus measures about 350 microns, and the glandular portion about 1·5 mm. The cephalic portion shews two lateral papillae anterior to the nerve ring; these are not exactly opposite each other. The ventral excretory pore opens very close behind the posterior border of the nerve ring.

The vulva is situated about 0·5 mm. in front of the anus. The vestibule and sphincter of the ovijector are very short. The vestibule is thickened in the distal portion, and contains nucleated muscle cells. It is lined by tall epithelial cells, which come into contact with each other at the free surface, leaving no visible lumen.

The uteri are very narrow, and are lined with large flat epithelial cells. They run parallel with each other and follow a very sinuous course. Numerous eggs are contained in them and the initial part of each is connected with the oviducts by a seminal receptacle of enormous size. The oviduct which leads from it is very narrow. The oviducts and the ovaries may be as much as 8 mm. in length.

The eggs have a thick smooth envelope, and the larvae at the time of hatching measure about 30 microns by 15. They collect in the uterus and pass through the ovijector without stopping there. About 50 may be found in each of the paired branches of the uterus.

The male is unknown.

MISCELLANEOUS.

(280) Watson (E. A.). **Preliminary Studies and Experiments with Swamp Fever.**—*Dept. of Agriculture, Canada. Report of the Veterinary Director General* (F. Torrance, B.A., D.V.S.) *for the Year ending* 31*st Mar.*, 1913. Ottawa: Printed by C. H. Parmalee. pp. 86-87.

The author's experience regarding the virulence of swamp fever blood when inoculated in series in horses agrees with that of Van Es and others in that there is a progressive loss. A sample of blood obtained from a natural case in the Onoway District, Alberta, produced an acute attack at the first and second passages, but subsequently only chronic forms of the disease, which terminated in recovery. In these animals clinical symptoms were practically absent.

It is suggested that this is an indication that under natural circumstances the disease is insect borne, the insect cycle being necessary for the retention of the full degree of virulence.

It has been found that swamp fever blood does not react to the serum tests used for trypanosome diseases, but that the globulin content of the blood is markedly increased.

(281) Panisset (W. L.). **Paralysie bulbaire Infectieuse. Pseudo-Rage, Maladie d'Aujeszky.** (Infectious Bulbar Paralysis. False Rabies, Aujeszky's disease.)—*Rev. Gen. Med. Vet.* 1914. June 1. Vol. 23. No. 275. pp. 601-618. With 4 text figs.

This article contains no new information regarding the disease, but summarises our knowledge of the condition.

(282) Jonesco-Michaïesti (C.) & Combiesco (D.). **Sur une Epidemie de Dysenterie Bacillaire chez des Singes inférieurs.** [An Epidemic of Bacillary Dysentery in the Lower Monkeys.]—*Compt. Rend. Soc. Biol.* 1914. May 22. Vol. 76. No. 17. pp. 827-829.

The outbreak described by the authors occurred among a number of *Macacus rhesus* kept for experimental purposes. The clinical features and the lesions presented no remarkable features.

The organism isolated on Conradi-Drigalski and in bile broth resembled the Flexner type of bacillus.

Only two sera were available for agglutination tests: a polyvalent serum prepared with the bacilli of Shiga, Flexner, Dopter, Duval, and Y, and a serum agglutinating only the Shiga type. The Shiga serum agglutinated the bacillus isolated in dilutions of 1 in 80 only. The polyvalent serum agglutinated the Flexner and Y types in dilutions of 1 in 300, and the Strong type and the bacillus isolated in 1 in 150.

The authors conclude that:

With regard to the majority of the cultural characters, the bacillus isolated belongs to a type of dysentery bacillus allied to Flexner's bacillus, while as regards agglutination it approaches more closely the bacillus of Strong.

(283) Landois (F.) & Hoepke (H.). **Eine endoparasitäre Milbe in der Lunge von *Macacus rhesus*.** [An Endoparasitic Acarus in the Lungs of *Macacus rhesus*.]—*Centralbl. f. Bakt.* 1. Abt. Orig. 1914. Apr. 25. Vol. 73. No. 6. pp. 384-395. With 1 plate and 3 text figs.

After summarising the recorded cases of endoparasitic acariasis the authors describe one occurring in the monkey.

The animal in which the lesions were found was one that was being used in a bone-transplantation operation at Breslau.

In each lung there were found eight to ten round nodules lying close under the pleura. They were not connected with a bronchus. In colour they varied from greyish-yellow to pale yellow, and on section shewed small, dry-looking centres about the size of lentils. The larger ones had crumbling material in the centre in which the acari could be detected with the microscope.

Histological examination shewed that the smallest nodules were composed of rounded and spindle-shaped cells, with a few leucocytes. At places there were collections of amorphous pigment granules of a reddish-brown colour. Tests of this pigment with potassium ferrocyanide gave negative results. The acari were found in the granular centres of the larger nodules, but none was found in the small nodules.

Material containing a single acarus was injected into the thoracic cavity of another monkey. Six months later this animal died and a single acarus was found in a nodule at the hilus of the left lung.

A detailed description of the parasite is given and the name *Pneumotuber macaci* is suggested for it.

(284) Bouquet (A.) & Nègre (L.). **Sur la Nature mycosique du Parasite de la Lymphangite epizootique. Formation de Gouttelettes d'Huile et de Filaments.** [The Mycotic Nature of the Parasite of Epizootic Lymphangitis. The Formation of Droplets of Oil and of Filaments.]—*Bull. Soc. Path. Exot.* 1914. June. Vol. 7. No. 6. pp. 464-466. With 10 text figs.

The authors bring forward the following evidence in support of their view regarding the blastomycotic nature of the Cryptococcus of Rivolta :—

In specimens prepared from tubes of agar medium which have been thickly sown with pus, incubated at 24°C. for a week, and then kept at room temperature for two months, the following vegetative forms have been observed :

In addition to the ordinary budding forms of the parasite there are certain organisms which have attained a size of twice the normal. These are found to contain refractile droplets or fine granulations. At the narrower pole of such parasites there is a cylindrical outgrowth which is granular and measures 2 microns in diameter. The longest outgrowth seen measured 18 microns and was divided by a septum into two equal parts. Similar large forms without any outgrowths may be found in the water of condensation and in milk inoculated with pus.

The refractile granules are spherical and at first small, but they may run together and form a large droplet nearly filling the cryptococcus. The oily nature of these droplets has been ascertained by staining with osmic acid.

(285) Balfour (A.). **The Wild Monkey as a Reservoir for the Virus of Yellow Fever.**—*Lancet.* 1914. Apr. 25. pp. 1176-1178.

Attention was directed to this subject on account of a negro belief in Trinidad that an outbreak of yellow fever can be foretold because large numbers of red howler monkeys are always found dead before such an outbreak occurs, and certain information obtained suggests that there is possibly some connection between the deaths among the monkeys and the occurrence of yellow fever in man. It is suggested that workers in other parts of the world should investigate the subject.

(In the correspondence columns of the *Lancet* for May 9, 1914, Low writes to the effect that monkeys can but rarely if ever be reservoirs for the yellow fever virus, and brings forward evidence of his own to support this view.)

(286) GIEMSA (G.). **Zur Schnellfärbung (Romanowsky-Färbung) von Trockenausstrichen.** [The Rapid Staining (Romanowsky Staining) of Dried Films.]—*Centralbl. f. Bakt.* 1. Abt. Orig. 1914. May. Vol. 73. No. 7. pp. 493-496. With 1 text fig.

In order to avoid certain defects in the method of rapid Giemsa staining published in 1910 the author has devised a new mixture which has the following composition :—

Azur II.-Eosin	3 gm.
Azur II.	0.3 „
Glycerine	25 „
Methyl alcohol	475 „

The solution is prepared warm, allowed to cool, and, after standing, is filtered. The solution is supplied under the name "*Farbfixierlösung nach G.*"

Slides having very thin films upon them are laid with the film side uppermost in special staining troughs which have ridges running across the bottom for the support of the slides.

The fixing and staining solution is dropped on to the slide from a drop-bottle until the whole of the film is covered, care being taken that the slide is absolutely horizontal. The trough is covered with a lid and left for half a minute, and in no case more than one minute.

In a wide measuring cylinder a mixture of 10 cc. of distilled water and 10 drops of the staining and fixing solution (*Farbfixierlösung*), or 10 drops of the original Giemsa solution, is prepared and this is poured into the trough so as to completely cover the slide. Gentle rocking completes the mixing of the solutions. The stain is then allowed to act for 10 minutes.

The specimen is washed in water, mopped, dried and mounted in liquid paraffin or in balsam that is free from acid.

This method differs from previous ones not only in the composition of this stain, but in the use of a staining mixture instead of water after the primary action of the staining and fixing fluid is completed. The object of this is to avoid the extraction of the stain from the specimen which occurs when water is used.

In the case of thick preparations they should be placed in distilled water or salt solution for a minute and again dried before staining, because this tends to dissolve the serous portion of the film which otherwise may become stained. Spirochaetes are said to be rendered especially distinct by this method.

The method is not so good for moist fixed preparations and for sections as the old method.

RECENT LITERATURE.

[Continued from this *Bulletin* Vol. 2, No. 2, pp. 110-112.]

Babesiasis (Piroplasmosis).

(287) MISSON (L.) Immunisation Artificielle contre la Piroplasmose du Bétail Européen importé au Brésil. [The Artificial Immunisation of Cattle imported into Brazil from Europe against Piroplasmosis.]—*Folia Microbiologica*, 1914. June 27. Vol. 3. No. 1, pp. 49–75. With 3 plates.

Foot and Mouth Disease.

(288) FAVERO (F.). Su la presenza di una sensibilizzatrice antiaftosa. [The Presence of a Sensitiser in Foot and Mouth Disease.]—*La Clinica Veterinaria*, 1914. Apr. 15–30. Vol. 37. No. 7–8, pp. 327–331.

(289) KALLERT (E.). Untersuchungen über Maul- und Klauenseuche. I. Mitteilung. Ueber die Bedeutung der v. Beteghschen Körperchen in der Aphthenlymphe. [Investigations into Foot and Mouth Disease. 1st Part. Significance of the von Betegh Bodies in the Lymph of the Aphthae.]—*Arbeit. a. d. Kaiserl. Gesundsheitsamte*, 1914. June. Vol. 47. No. 4, pp. 591–602. With 2 plates.

(290) KALLERT (E.). Untersuchungen über Maul- und Klauenseuche. II. Mitteilung. Beiträge zur Histogenese und Histologie der Maul- und Klauenseucheblase, inbesondere auch zur Frage des Vorkommens von Einschlusskörperchen in den spezifisch veränderten Teilen bei Maul- und Klauenseuche.—[Investigations into Foot and Mouth Disease. 2nd Part. Histogenesis and Histology of the vesicles in Foot and Mouth Disease, especially in regard to the Occurrence of Inclusion Bodies in the specificially changed Parts.]—*Arbeit. a. d. Kaiserl. Gesundsheitsamte*, 1914. June. Vol. 47 No 4, pp. 603–613. With 2 plates.

(291) WEHRLE (E.) & KALLERT (E.). Versuche mit "Trypasafrol" und "Novotrypasafrol" sowie mit "Ernanin" bei Maul- und Klauenseuche. [Experiments with "Trypasafrol," "Novotrypasafrol," and "Ernanin" in Foot and Mouth Disease.]—*Berl. Tierärtz. Wochenschr.*, 1914. April 9. Vol. 30. No. 15, pp. 253–257.

Leishmaniasis.

(292) CARINI (A.). L'Emétique dans le Traitement de la Leishmaniose cutanée et muqueuse. [Emetic in the Treatment of Leishmaniasis of the Skin and Mucous Membranes.]—*Bull. Soc. Path. Exot.*, 1914. April. Vol. 7. No. 4, pp. 277–281.

Malaria.

(293) PITSCHUGIN (P. I.). Kultivierungsversuche mit *Plasmodium vivax* nach der Methode von Bass. [Cultivation Experiments with *Plasmodium vivax* according to Bass's Method.]—*Centralbl. f. Bakt.*, 1. Abt. Orig., 1914. Apr. 25. Vol. 73. No. 6, pp. 373–384.

(294) STEPHENS (J. W. W.). A New Malaria Parasite of Man.—*Proc. Roy. Soc.*, 1914. April 8. Vol. B. 87. No. B 596, pp. 375–377. With 3 plates.

(295) THOMSON (D.). The Origin and Development of Gametes (Crescents) in Malignant Tertian Malaria; some Observations on Flagellation, etc. (Being Part II of the Reports on the Malarial Expedition to Panama, 1912.)—*Ann. Trop. Med. and Parasit.*, 1914. Apr. 21. Vol. 8. No. 1, pp. 85-104. With one coloured plate.

Rabies, False.

(296) SANGIORGI (Giuseppe). La Filtrabilità del Virus della Pseudorabbia.—*Giorn. R. Accad. Med. di Torino*, 1914. Mar.-Apr. Vol. 77. No. 3–4, pp. 69–78.

(297) SANGIORGI (Giuseppe). Ricerche sulla Pseudorabbia.—*Pathologica*, 1914. June 1. Vol. 6. No. 134, pp. 282–284.

Trypanosomiasis.

(298) CARINI (A.) & BOTELHO, jnr. (C.). Sur quelques Trypanosomes d'Oiseaux du Brésil. [Some Bird Trypanosomes of Brazil.]—*Bull. Soc. Path. Exot.*, 1914. May. Vol. 7. No. 5, pp. 395–398. With 3 text figures.

(299) CARINI (A.) & MACIEL (J.). Existence de la Maladie de Chagas dans l'Etat de Sâo Paulo. [The Existence of Chagas disease in Sao Paulo (Brazil).]—*Bull. Soc. Path. Exot.*, 1914. Apr. Vol. 7. No. 4, pp. 289–292.

(300) LEGER (A.) & LEGER (M.). Trypanosomes et Haemoproteus d'Oiseaux du Haut-Sénégal et Niger. [Trypanosomes and Haemoproteus of Birds of Upper Senegal and Niger.] —*Bull. Soc. Path. Exot.*, 1914. June. Vol. 7. No. 6, pp. 493–497. With two tables.

Biting Flies.

(301) AUSTEN (E. E.). A Dipterous Parasite of *Glossina morsitans*.—*Bull. Entomol. Research*, 1914. Apr. Vol. 5. No. 1, pp. 91–93. With 1 text figure.

(302) FROGGATT (W. W.). Sheep-Maggot Flies in Australia. *Bull. Entomol. Research*, 1914. Apr. Vol. 5. No. 1, pp. 37–39.

(303) LLOYD (Ll.). Further notes on the Bionomics of *Glossina morsitans* in Northern Rhodesia.—*Bull. Entomol. Research*, 1914. Apr. Vol. 5. No. 1, pp. 49–60. With 4 plates and 1 map.

(304) NEWSTEAD (R.) and DAVEY (J. B.). First Preliminary Report on the Bionomics of *Glossina morsitans*.—*Reports of the Sleeping Sickness Commission of the Royal Society*. 1914. No. 15, pp. 142–157. With 3 plates.

Helminths.

(305) JOHNSTON (T. H.). Second Report on the Cestoda and Acanthocephala collected in Queensland.—*Ann. Trop. Med. & Parasit.*, 1914. Apr. 21. Vol. 8. No. 1, pp. 105–112. With 1 plate.

(306) NICOLL (W.). The Trematode Parasites of North Queensland. II. Parasites of Birds.—*Parasitology*, 1914. June. Vol. 7. No. 2, pp. 105–126. With 2 plates comprising 13 figures.

Protozoa

(307) DELANOË (P.) & DELANOË (Mme.). De la Rareté de *Pneumocystis Carinii* chez les Cobayes de la Région de Paris. Absence de kystes chez d'autres Animaux (Lapin, Grenouille, 3 Anguilles). [The infrequent Occurrence of *Pneumocystis carinii* in Guinea-pigs in the Neighbourhood of Paris. Absence of Cysts in other Species (Rabbit, Frog, and 3 Eels).] —*Bull. Soc. Path. Exot.*, 1914. Apr. Vol. 7. No. 4, pp. 271–272.

(308) LEGER (M.) & LEGER (A.). Hématozoaires des Reptiles du Haut-Sénégal-Niger. [Haematozoa of Reptiles in Upper Sénegal and Niger.]—*Bull. Soc. Path. Exot.*, 1914. June. Vol. 7. No. 6, pp. 488–493. With 6 text figures.

(309) MINE (N.). Beiträge zur Kenntnis der Blutparasiten der Vögel in Japan. [The Blood Parasites of Birds in Japan.]—*Arch. f. Protistenkunde*, 1914. May 14. Vol. 34. No. 2, pp. 198–211. With 2 plates in colour comprising 109 figures.

(310) MOLDOVAN (J.). Untersuchungen über den Zeugungskreis des *Leucocytozoon ziemanni* (Laveran). [Investigations regarding the Developmental Cycle of *Leucocytozoon ziemanni*.]—*Arch. f. Protistenkunde*, 1914. June 17. Vol. 34. No. 3, pp. 249–262. With 2 plates.

(311) SCHEFERLING. Blutkörperchen und Blutparasiten. [Blood Corpuscles and Blood Parasites.]—*Zeitschr. f. Veterinärkunde*, 1914. May. Vol. 26. No. 5, pp. 214–219.

Unclassed.

(312) CARPANO (Matteo). Su di alcuni Spirocheti rinvenuti in Neoformazioni papillomatose degli Equini. [Certain Spirochaetes met with in Papillomatons Neoplasms in Horses.]—*Annali d'Igiene Sperimentale*, 1914. Vol. 24 (Nuova Serie). No. 2, pp. 275–283. With 1 plate and 1 fig.

(313) CARPANO (Matteo). Die nekrotisch-gangränösen Affektionen in der Veterinärpathologie. Die fuso-spirilläre Symbiose. [Necrotic and Gangrenous Affections in Veterinary Pathology. The Pseudo-spirillar Symbiosis.]—*Centralbl. f. Bakt.*, 1. Abt. Orig. 1914. June 13. Vol. 74. No. 3–4, pp. 225-241. With 1 plate.

(314) CLANDON. Sur certaines Maladies du Mouton au Maroc. [Certain Diseases of the Sheep in Morocco.]—*Receuil. Méd. Vét.*, 1914. Apr. 30. Vol. 91. No. 8, pp. 151–155.

(315) GROSSO (G.). Pathologisch-anatomische Veränderungen des Darmes und der Lunge des Affen (Macacus) durch tierische Parasiten verursacht. [Lesions in the Intestine and Lungs of the Monkey caused by Animal Parasites.]—*Zeitschr. f. Infektionskrankh. parasit. Krankh. u. Hyg. d. Haust.*, 1914. May 8. Vol. 15. Nos. 3–4, pp. 261–267. With 2 plates comprising 7 figures and 4 text-figures.

(316) MEISSNER (W.). Das Kamelgestüt Kalkfontein-Nord der Kaiserlichen Schutztruppe in Deutsch-Südwestafrika. [The Kalkfontein-Nord Camel Stud of the Imperial Defence Force in German South West Africa.]—*Zeitschr. f. Veterinärkunde*, 1914. Apr. Vol. 26. No. 4, pp. 161–168.

TROPICAL DISEASES BUREAU.

TROPICAL VETERINARY BULLETIN.

VOL. 2.] 1914. [No. 4.

BABESIASIS (PIROPLASMOSIS) AND ANAPLASMOSIS.

(317) LAVERAN (A.) & FRANCHINI (G.). **Contribution à l'Etude des "Marginal Points" des Hématies des Mammifères.** [Contribution to the Study of "Marginal Points" in the Blood Corpuscles of Mammals.]—*Bull. Soc. Path. Exot.* 1914. July. Vol. 7. No. 7. pp. 580–584.

This paper contains a brief resumé of the references in literature to marginal points and to bodies having a close morphological resemblance to them.

The authors' observations have been carried out upon the blood of young animals of different species, and they have been able to find bodies having the morphological characters of marginal points in a number of them.

The blood of ten white mice weighing from 2 to 10 grammes was examined. In four of these anaplasma-like bodies, which the authors definitely describe as anaplasms, were not rare, and in the remainder they were present in small numbers. They were found in very small numbers in the blood of one of three adult white mice.

The authors have also discovered similar bodies in young grey mice and white rats, and in the blood of young rabbits and guinea-pigs, moles, cats, dogs, calves, goats, pigs, donkeys, and monkeys.

The morphology and staining reactions of the bodies are briefly described.

The authors conclude that bodies morphologically identical with those described by THEILER occur in the blood of young mammals apart from any infection, and that it does not appear to be possible to consider these as being of a parasitic nature. But it is said that, from the observations of SMITH and KILBORNE, and a number of other authors, it is possible that anaplasma-like bodies may represent a stage in the development of certain piroplasms.

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(318) CARPANO (M.). **Le Recidive nella Piroplasmosi. Su di un Tipico Caso di Recidiva nell'Asino.** [Relapses in Piroplasmosis. A Typical Case of Relapse in the Donkey.]—*La Clinica Veterinaria.* 1914. July 15. Vol. 37. No. 13. pp. 535–542. With 1 chart and 1 text fig.

In some of his previous papers the author has called special attention to the presence of latent forms of the parasite which occur in the blood of animals, and especially horses, affected with piroplasmosis, these forms having the morphological characters of anaplasms. They become active when for any reason the vitality and resistance of the host is lowered. A donkey which failed to become infected when inoculated subcutaneously with blood containing a small number of *Babesia caballi*, and also when subsequently inoculated intravenously with blood containing large numbers of *Nuttallia equi*, and was therefore immune to these parasites, had a relapse following an intravenous injection of streptococcic endotoxin derived from a very virulent strain.

Parasites of the Nuttallia type were found in the blood on the 12th and 13th days after the inoculation, and there was some amount of systemic disturbance.

The animal had been at the laboratory for 14 months before the injection which gave rise to the relapse was administered, and during that time it had not been exposed to infection by means of ticks.

(319) MARTINEZ (I. G.). **Canine Babesiasis in Porto Rico.**—*Jl. Trop. Med. & Hyg.* 1914. July 1. Vol. 17. No. 13. p. 194.

Martinez briefly records the discovery of *Babesia canis* in the blood of dogs during the routine examinations for epizootic diseases and for rabies.

(320) GOODALL (A.). **The Trypanblue Treatment in Piroplasmosis of Domesticated Animals in South Africa.**—*Parasitology.* 1914. May. Vol. 7. No. 1. pp. 62–68.

The notes contained in this paper are the outcome of the writer's experience of the use of the drug under practical conditions in country districts.

The solution used in every case was a 2 per cent. solution, made up with rain water, filtered and sterilised.

For dogs the dose used varied from 5 to 30 cc. according to the patient's weight, and was given subcutaneously.

Horses and large mules received 200 cc.; donkeys, ponies and small mules, 150 cc.; and cattle, 50 to 250 cc. In each of the latter cases the drug was given intravenously.

Good results have been obtained with all the species mentioned, and details are given of a few cases in each species. Conclusions :—

" 1. Parasites are not always present in the peripheral blood of dogs, and are often extremely difficult to find in other animals, especially under conditions encountered in the field. If well-marked clinical symptoms are shown one is justified in using Trypanblue, even if parasites cannot be satisfactorily demonstrated.

"2. A large dose of a weak solution of Trypanblue should be administered. The writer cannot help thinking that the failures attributed to the drug by other observers are due, in many cases, to too small a quantity of the solution being injected.

"3. After an experience of the treatment in some hundreds of cases, the writer feels justified in stating that animals do not suffer from relapses if a sufficient quantity of the solution is used.

"4. The dog can become infected a second time after Trypanblue treatment, but this second infection is also amenable to the drug."

TRYPANOSOMIASIS.

(321) Bruce (D.), Hamerton (A. E.), Watson (D. P.) & Lady Bruce. **Trypanosome Diseases of Domestic Stock in Nyasaland. III.—** *Trypanosoma pecorum.* **Development in** *Glossina morsitans.*—*Proc. Roy. Soc.* 1914. Aug. 6. Series B. Vol. 88. No. B 600. pp. 33–37. With 1 coloured plate.

In a previous paper the authors have described the morphology and pathogenic range of this trypanosome, and in the present paper an account is given of its development in *G. morsitans.*

The trypanosome belongs to the group which does not invade the salivary glands. The development first takes place in the gut, and then extends forwards to the proboscis and hypopharynx, where the development into "blood forms" occurs.

Seven transmission experiments were carried out, and of these five were positive. Two of these were at laboratory temperature, and in the remainder the flies were kept in an incubator. Ten per cent. of the flies used were found to be infected.

From the details given it appears that a period of from 19 to 53 days may elapse before flies become infective.

In the positive experiments the majority of the flies showed infection of the proboscis, and all showed infection of one or more portions of the intestine. The salivary glands were always negative.

In the negative experiments there was infection of the labial cavity of one only. One or more parts of the intestine showed infection in every case, but the salivary glands were uniformly negative.

The coloured plate shows the cycle of developmental forms of *T. pecorum* in *G. morsitans.* In the intestine long parasites which are indistinguishable from the corresponding forms of other pathogenic parasites occur. When attached to the labrum the crithidial form is assumed, and in the proboscis the "blood forms," which are the only infective form, are developed.

(322) Bruce (D.), Hamerton (A. E.), Watson (D. P.) & Lady Bruce. *Glossina brevipalpis* **as a Carrier of Trypanosome Disease in Nyasaland.**—*Proc. Roy. Soc.* 1914. Aug. 6. Series B. Vol 88. No. B 600. pp. 20–32. With 1 coloured plate.

G. brevipalpis is found in a tract of country estimated at about 5 square miles at the mouth of the Lingadzi river on the west shore of Lake Nyasa. This area is traversed by two main roads, one running

east and west and the other parallel to the shore and about one mile west of it.

During the day no specimens of the fly are ever seen, but as evening approaches specimens may be seen sitting motionless in the road. They do not settle upon or follow passers-by, and would take no notice of a dog repeatedly walked through their haunts towards evening. They do not move about in search of food, nor do they chase each other.

Five hundred flies were caught and every one was a male. Some of them were found on dissection to contain mammalian blood. When kept in captivity they remain dormant on the sides of their cages during the day, but become active at night. If the side of the cage be placed up against a dog or a goat they will feed with avidity at any time during the day or night.

Examinations made to ascertain the natural food shewed that of 59 flies examined seven contained blood. In six cases it was probably that of antelope and in the other human.

Of the several hundred flies dissected, only four were found to be females, and it would appear that while the males are found on the paths the females remain in the jungle. The same kind of thing was observed to a lesser extent with *G. morsitans*.

Dissections of wild flies shewed that 44 out of 496 were infected with trypanosomes.

While trypanosomes were found in the proboscis, and in one instance in the salivary glands, the great bulk of them occurred in the mid and fore-gut, and in the smaller number of cases in the hind gut.

It is stated that in 19 cases it was possible to make a more or less correct guess at the identity of the trypanosomes found in the flies. These are *T. brucei* vel *rhodesiense*, 1; *T. pecorum*, 9; *T. simiae*, 1; and *T. grayi*, 8. In 10 flies the flagellates were considered to belong to a pathogenic type of unknown species, and in the remainder no opinion could be expressed.

Five experiments were made with flies brought from the lake shore; in each case a monkey, a dog, and a goat being used for feeding experiments. In only one case was the result positive, *T. pecorum* being found.

A number of experiments were carried out to ascertain whether *G. brevipalpis* is capable of acting as a carrier of various pathogenic trypanosomes.

T. brucei vel *rhodesiense*.—Wild flies were used in the experiments, as it was found to be impossible to breed flies for the purpose, both on account of the distance that they had to be carried from the lake to the laboratory (50 miles), and on account of the scarcity of the flies.

Wild flies were fed upon animals infected with the trypanosome causing disease in man in Nyasaland and then upon healthy animals. In six experiments 232 flies were used, but the result was negative in every instance. Fifty-three flies were dissected and eight infected flies were found. In one of these there was infection of the proboscis and alimentary tract, in one infection of the salivary gland and of the alimentary tract, and in the remainder infection of the aimentary tract only. The two flies in which there was infection other than

that of the intestine were found in one batch. That in which the salivary glands were found to be infected was dissected at the 33rd day, and the other at the 46th day. The former of these had the salivary glands swarming with trypanosomes, and, although inoculation of a rat failed, it is thought probable that it represented a true development of the Nyasaland trypanosome, the development not having reached the infective stage.

In a coloured plate are shewn the morphological details of the trypanosomes occurring in the fly.

In the intestine of the fly long slender forms are found, and these invade the salivary glands. Here the parasite acquires a crithidial form, in which the posterior extremity is attenuated while the anterior end becomes broader. Later the posterior portion becomes short again and the parasite is short and thick. The parasite then becomes rounded in form, and masses of them in this condition are found in the lumen of the glands. These masses break up into individuals in which the micronucleus is again posterior and the parasite gradually assumes the fully developed trypanosome, or "blood form." It is pointed out that although wild flies were used, this is the only type of trypanosome which invades the salivary glands of the flies in the district and that therefore *T. pecorum*, *T. simiae*, and *T. caprae* are excluded.

T. brucei Zululand, 1913.—Three experiments were carried out, using 200 flies. One was positive and two negative.

Only 12 flies were dissected, and in one long trypanosomes apparently of the pathogenic type were found in the intestine, but it was impossible to identify them. A dog became infected 58 days after the flies had been fed upon an infected dog. Only two flies of this batch were dissected, and both were negative. It is probable that the dog was infected by a fly in which development of *T. brucei*, Zululand, had taken place, as if there had been a fly in the cage naturally infected with the Nyasaland strain, the dog ought to have shewn trypanosomes earlier than the 58th day.

Further experiments of the same kind shewed that *G. brevipalpis* is capable of acting as a carrier for both *T. pecorum* and *T. caprae*. The flies dissected in these experiments shewed trypanosomes in the proboscis and intestine, but not in the salivary glands.

(323) CHALMERS (A. J.) & O'FARRELL (W. R.). **Sleeping Sickness in the Lado of the Anglo-Egyptian Sudan.**—*Jl. Trop. Med. & Hyg.* 1914. Sept. 15. Vol. 17. No. 18. pp. 273–284. With 1 map and 5 charts.

In this paper are compared *T. rhodesiense* and the Yei strain of trypanosomes. The former was brought from Liverpool and the latter was obtained from patients at Yei in the Lado district of the Mongalla Province.

The experimental work was done at Khartoum owing to the possibility of introducing *T. rhodesiense* into the sleeping sickness area. The patients infected with the Yei strain were not brought to Khartoum for examination because of the danger of spreading the disease, and because it was not desired to interfere with their treatment.

All the blood films were fixed wet with osmic acid vapour for about four seconds and then transferred to absolute alcohol, in which they

were kept for two to five minutes. Giemsa's stain was used in two dilutions: either 1 drop to 1 cc. with the addition of a drop or two of 1 per 1,000 potassium carbonate, in which they were stained for an hour or longer, or 2·5 cc. to 100 with 5 drops of carbonate solution. in which they were stained for 5 to 24 hours.

A summary of the state of affairs regarding African human trypanosomes and an interesting account of the history of the occurrence of sleeping sickness in the countries adjoining the Lado are given.

From these it appears that there are two main areas of infection in the Mongalla Province, namely a western area centered round Yei, and an eastern area adjoining Kajo-Kaji.

The Yei strain was obtained from a monkey inoculated by RANKEN from a patient at the Sleeping Sickness Segregation Camp at Yei.

It would appear that these two districts obtained their infection originally from two different sources. The first appears to have been infected from the Belgian Congo and possibly through the medium of Baganda traders. The source of the infection of the second district appears to have been Uganda.

The infected animals, two monkeys and a dog, were inoculated from an untreated case.

The authors state that the strain may represent the strain present in Uganda or that on the Congo, but they consider this to be of little importance as they believe that the Uganda infection was originally derived from the Congo.

Morphology.—The parasite varied in length from 18 to 36 microns, and in width from 1 to 2·5 microns. The average length of 1,000 trypanosomes, measured 100 daily, in the blood of an infected monkey was 25 microns. Measuring was commenced on the first day that the animal shewed a heavy infection, viz., the 10th, and it was continued to the 19th day. The monkey died on the 33rd day. A posterior-nuclear form was never observed.

Animal experimentation shewed that the virulence of the trypanosome for dogs, cats, rabbits, gerbils, jerboas, white rats, and monkeys, is less than that of *T. rhodesiense*, but greater than that of *T. nigeriense* Scott-Macfie.

In the dog the period of incubation was 12 days, and the animal often lived several months. In the monkey the period of incubation was nine days, and the duration of life averaged about 35 days. In the gerbil the period of incubation was 7 days, and the duration of life 14.

A dog was rendered immune, i.e., its peripheral blood failed to shew trypanosomes for more than 60 days after its fifth inoculation with the Yei strain. The last tested gerbil inoculated with the blood of this dog failed to become infected.

The serum of this dog destroyed the Yei trypanosome in vitro in 20 minutes, but was without effect upon *T. rhodesiense* after an hour.

At a time when the immunity was incomplete the serum was mixed with the different strains of trypanosomes and immediately inoculated into gerbils. In the case of the Yei strain an infection resulted, and the animal was recovering from it when it died of heat stroke along with 49 other animals. This occurred on the 39th day. The *rhodesiense* mixture resulted in an infection which proved fatal on the 7th day.

When the immunity was complete the serum was mixed with infected blood in the proportion of 10 to 1, and after 30 minutes was injected into gerbils. No trypanosomes were seen in the blood of the gerbil inoculated with the Yei strain, but it was killed accidently on the 13th day after inoculation. No trypanosomes were found in the internal organs, but smears from the lungs shewed perculiar bodies contained in cells which resembled the granules found in the spleens of patients and of animals inoculated with kala azar. With *T. rhodesiense* the gerbil died of infection on the 10th day.

Cross immunity is to be dealt with in a subsequent paper.

Cytolytic sera.—Human serum was not found to have any trypanolytic effect upon either of the human strains of trypanosomes or upon two strains of mule trypanosomes, but it did appear to have a distinctly beneficial effect upon the Yei strain, as after an hour the trypanosomes were more active than at the commencement of the observation.

It is recorded that a strong though incomplete agglutination was observed to be produced by a normal human serum upon a mule strain of trypanosomes, and it is pointed out that if this is admitted agglutination is useless as a specific test.

No experiments have been carried out regarding the transmission of the trypanosomes.

A detailed comparison is made with each of the other human trypanosomes, excluding the original strain of DUTTON, 1902, which the authors have not been able to trace.

The conclusions arrived at may be summarised as follows:—

The strain sent in by RANKEN and the Congo strain are the same, and probably they and the Uganda strains are identical. There being no data of which the authors are aware to compare these strains with *T. gambiense*, Dutton, 1902, they think that provisionally it would be safer to keep the name *T. castellanii*, Kruse, 1903, for these strains until more light is thrown upon the question as to what is *T. gambiense*, Dutton, 1902.

It appears that sleeping sickness in Africa can be divided into three categories.

(1) Southern sleeping sickness caused by *T. rhodesiense* and spread by *G. morsitans*.

(2) Equatorial sleeping sickness caused by *T. castellanii*, Kruse, 1903, and spread by *G. palpalis*.

(3) Northern sleeping sickness which may be caused by as yet imperfectly known trypanosomes, named:—

(*a*) *T. gambiense*, Dutton, 1902.

(*b*) *T. nigeriense*, Scott-Macfie, 1913, and possibly other trypanosomes.

The authors believe that BRUCE'S method of charting trypanosomes and LAVERAN and MESNIL'S method of cross-immunity testing are both of distinct value in the comparison of parasites.

The question as to why some cases of the disease in the Lado Enclave are exceedingly chronic while others are very acute may be answered in two ways. The more probable reason is that the chronic cases occur in the area that has been longest infected, while the acute cases occur in the area which has recently become infected.

The less likely answer is that there are two forms of the disease.

(324) MESNIL. (F.) & RINGENBACH (J.). **Sur le *Trypanosoma rhodesiense* et ses Affinités avec le *Tr. gambiense*. Quatrième Note.** [*Trypanosoma rhodesiense* and its Affinities with *T. gambiense*. Fourth Note.]—*Bull. Soc. Path. Exot.* 1914. July. Vol. 7. No. 7. pp. 612–618.

The authors refer to a paper published by them in 1911 in which it was recorded that a monkey which had a strong immunity to two strains of *T. gambiense* subsequently became infected with *T. rhodesiense* although the period of incubation and the duration of life were longer than in monkeys having no immunity to *T. gambiense*.

Reference is also made to LAVERAN'S experiment in which a goat immune to *T. gambiense* contracted a fatal infection which lasted only 35 days when inoculated with *T. rhodesiense*.

The conclusion is drawn from these results and from those of MESNIL and LEGER, in which mice inoculated with *T. rhodesiense* and cured with arsenophenylglycin were tested as to their susceptibility to *T. gambiense*, that the two viruses constitute distinct but closely related species.

The present paper records experiments carried out with a strain of *T. rhodesiense* (Case 16, W. G.) obtained from WENYON, and the strain originally studied by the authors in 1911–12.

In the opinion of the authors, negative results obtained with cross immunity experiments are less conclusive than positive ones.

In the rat WENYON found that the duration of life varied from 12 to 39 days, but in the series of passages through the rat carried out by the authors the period ranged from five to 18 days only.

In the mouse the course of the infection is still more variable than in the rat. The duration of life varied from four to 25 days, and in cases in which the animals survived for more than 15 days crises occurred during which trypanosomes were not discoverable in the blood by microscopical examination. In the course of the later passages the duration of life was longer than in the earlier ones.

A similar variability of effect was also observed in the guinea-pig.

The authors' own strain, on the other hand, was markedly constant in its effects. Mice were regularly killed in four days.

Guinea-pigs died in 28 and 22 days, as compared with 19 and 79 days with WENYON'S strain.

A series of experiments was carried out with four goats, two of which were immune to *T. gambiense* and two susceptible. Each of the strains of *T. rhodesiense* was used to inoculate an immune and a susceptible goat.

Goat B. immune to *T. gambiense*.—Inoculated with the authors' strain of *T. rhodesiense* became infected and died. Trypanosomes appeared in the blood in small numbers a month after inoculation, and they were observed on a number of occasions afterwards, but apparently always in small numbers. The goat died six weeks after the appearance of trypanosomes in the blood. There was oedema of the face and simple keratitis. Duration of life, 68 days.

Goat B[1]. Non-immune to *T. gambiense*.—Infection resulted, but trypanosomes were not numerous in the blood. There was slight oedema of the face, but there is no mention of keratitis. The animal died in 42 days.

Goat C. Immune to *T. gambiense.*—Inoculated with WENYON's strain. Although a single trypanosome was seen in the blood on one occasion only about seven weeks after inoculation, the infectivity of the blood was repeatedly proved by the inoculation of mice. The animal died on the 54th day.

Goat C[1].—Non-immune goat inoculated with WENYON's strain of *T. rhodesiense.* Microscopic examination of the blood was negative throughout, but its infectivity was proved by the inoculation of mice from time to time. The animal died on the 61st day.

It is concluded from these experiments that the evidence tends to show that *T. rhodesiense* and *T. gambiense* are distinct.

A few serum experiments were carried out, and it was found that the sera of the two non-immune goats possessed no activity against *T. gambiense.* The sera of Goats B and B[1] were found to be active against *T. rhodesiense* of the authors' strain, but to be practically without effect upon WENYON's strain. The sera of Goats C and C[1] were found to be fairly active against WENYON's strain, but very slightly against the authors' strain.

In 1911 the authors stated that their strain of *T. rhodesiense* behaved like an animal trypanosome of the nagana type from the point of view of the action of human serum upon it. WENYON's strain was found to have practically the same property.

(325) BRUCE (D.), HAMERTON (A. E.), WATSON (D. P.) & Lady BRUCE. **Infectivity of *Glossina morsitans* in Nyasaland during 1912 and 1913.**—*Proc. Roy. Soc.* 1914. Aug. 6. Series B. Vol. 88. No. B 600. pp. 43–48.

During 1912, 1,975 flies were caught and dissected. Of these 86 per cent. were males and 14 per cent. females. 6·53 per cent. were found to be infected with trypanosomes. In 1913, 1,060 flies were dissected, and 8·58 were found to be infected.

During 1912, 60 attempts were made to determine the infectivity of the flies by injecting the intestinal contents into animals, but only three inoculations were positive. This was no doubt to a large extent due to the fact that the intestinal forms are not infective, a point subsequently discovered. In only two cases were the salivary glands found to be infected. Inoculation of these glands into rats confirmed the diagnosis that the infection was *T. brucei* vel *rhodesiense.*

In 1913, an attempt was made to diagnose directly the species of trypanosome with which the fly were infected, and no injections were made.

Invasion of the salivary glands could only be *T. brucei* vel *rhodesiense*; invasion of the intestine, labial cavity and hypopharynx meant *T. pecorum* or *T. simiae*, and size would distinguish between these. Lastly, if only the labial cavity and hypopharynx were seen to contain flagellates, *T. caprae* was indicated.

T. brucei vel *rhodesiense* was found once, *T. pecorum* six times, *T. simiae* 12 times, and *T. caprae* 14 times.

(326) Bruce (D.), Hamerton (A. E.), Watson (D. P.) & Lady Bruce. **Trypanosomes found in Wild *Glossina moritans* and Wild Game in the "Fly-Belt" of the Upper Shiré Valley.**—*Proc. Roy. Soc.* 1914. Aug. 6. Series B. Vol. 88. No. B 600. pp. 38–41.

The "fly-belt" in question extends along the Upper Shiré River Valley from Lake Pamalombe to the Murchison cataracts. It is about 100 miles south of Kasu. It is separated from the "fly" area on the west shore of Lake Nyasa by a range of hills where fly is absent, but which forms no obstacle to the passage of infected animals from one area to the other.

Game is abundant in the district, particularly in the dry season. Cases of trypanosomiasis have been observed in man, and the natives are unable to keep cattle. Their goats and dogs are constantly being destroyed by trypanosomiasis.

Seven experiments were carried out, but only dogs and goats were used, as there were no monkeys available. The different batches of flies, which numbered from 73 to 650 in a batch, were allowed to feed upon a dog and a goat twice.

Six of the dogs became infected with *Trypanosoma brucei* vel *rhodesiense*. Two of these were at the same time infected with *T. pecorum*, and one contracted a *pecorum* infection alone. These were the only trypanosomes found in the dogs.

Six of the goats became infected with *T. pecorum*, one of these also had *T. simiae*, four were infected with *T. caprae*, and one showed a *caprae* infection only.

These experiments show that the fly in the Upper Shiré district carries the same species of trypanosomes as those found in the flies from the Proclaimed Area.

A zebra, 7 impala, 2 koodoo, and 6 waterbuck were examined for trypanosomes, the examination involving the microscopic examination of blood preparations. *T. brucei* vel *rhodesiense* was found in one waterbuck, *T. pecorum* was found in 2 impala and 2 waterbuck, *T. caprae* was found in an impala, a koodoo, and a waterbuck, and *T. ingens* was found in one waterbuck.

(327) Bruce (D.), Hamerton (A. E.), Watson (D. P.) & Lady Bruce. **The Food of *Glossina morsitans*.**—*Proc. Roy. Soc.* 1914. Aug. 6. Series B. Vol. 88. No. B 600. pp. 41–42.

Five hundred flies, freshly caught in the Proclaimed Area, were killed by chloroform and a smear made from the intestine of each. These were fixed with osmic acid and alcohol, stained with Giemsa, and examined for the presence of blood corpuscles.

The proportion of male to females was roughly two to one.

Of the 500 flies examined, 57·6 per cent. were found to contain mammalian blood in a recognisable state. No measurements of the corpuscles were made owing to changes in the corpuscles induced by digestion, but cells of the small type such as are seen in the blood of antelope predominated.

In three cases nucleated red corpuscles were found, and in one of these only were there no mammalian corpuscles present at the same time. Measurement of these corpuscles showed that they were in all

probability avian and not reptilian. No vegetable matter was found in any of the flies.

From experiments carried out with laboratory flies it appeared that blood was not recognisable after the third day. Hence it may be inferred roughly that half the flies examined had fed within three days, and that therefore flies naturally feed at least once in six days.

Trypanosomes were recognised in 2·8 per cent. of the flies, and it is probable that a higher percentage was actually infected.

(328) Owen (G. E.). **Mechanical Transmission of Trypanosomiasis.**—*Jl. Comp. Path. & Therap.* 1914. Sept. Vol. 27. No. 3. pp. 259–260.

The author's object in writing this paper is to point out the possibility of mechanical transmission becoming serious under suitable conditions, rather than to lay stress upon its frequency and importance.

During the period 1908–1913, cattle to the number of 2,500-3,000 died from trypanosomiasis in the Barotse reserve of Northern Rhodesia, although the district is free from *Glossina morsitans*. Special interest attaches to the fact that the mortality began each year about the beginning of February and ceased after June. The wet season, when flies are most numerous, lasts from December to March.

There were in the district some dozen horses, some being bred every year, and large numbers of sheep, dogs and goats, but no natural case of trypanosomaisis had ever been encountered among these animals. The explanation of this fact did not lie in the trypanosome being pathogenic for cattle only, as the author found all the other species susceptible to it, and particularly the dogs.

In seeking an explanation of these facts the first point of importance is that the trypanosomiasis was definitely confined to certain herds, others grazing over the same ground being free, and in every native herd there was a history of exchanging cattle with, or hiring to traders and transport riders.

In 1908, an owner came into the district with sick cattle. He lost the majority of them from trypanosomiasis in three years, and with his advent the disease became very noticeable.

In 1912, when the writer went to investigate, he at once resorted to isolation, with the result that in 1913 he had over 800 head of cattle without loss in an area which had been the centre of the disease the previous year. These animals remained out of a lot of 1,100. They were carefully watched for about six months after the fly season, all infected and suspected animals being removed before the flies became numerous again.

During April and May, 1912, the author saw 200 cases, whereas from February to May inclusive 1913 only five cases were seen, all occurring in a suspected herd.

Had a fly or a tick been associated in the transmission, the disease could not have remained confined to certain herds while others on the same veld remained unaffected.

Tabanidae, Haematopota and Stomoxys are the commonest flies in the district.

During the months when the flies are most numerous and during the hot period of the day, the cattle crowd together for mutual pro-

tection. To watch a herd crowded together and see the Tabanidae swarming on them is sufficient to impress one with the fact that the conditions are very favourable for mechanical transmission.

The following experiment was made :—

Two kraals were erected within 10 yards of each other. In one two healthy cows and a heifer were placed, and in the other two healthy cows and two infected cows. The cattle from the two kraals were grazed over the same ground, but never at the same time, and the kraals were occasionally changed.

The two healthy cattle in the second kraal became infected, but the healthy animals in the other kraal remained uninfected. The object of exchanging the kraals was to ascertain whether mosquitoes in the kraals would act as transmitters.

Dogs, sheep, and goats were exposed to infection by mixing healthy with clean, but no infection resulted.

It was noticed that while dogs allowed Stomoxys to feed upon them freely, they bit at any Tabanidae coming near them. No positive results were obtained with experiments carried out to test cyclical or mechanical transmission with either of these species.

The author came to the conclusion that the trypanosome, which was not identified, but was responsible for a chronic infection in the cattle, was transmitted in a mechanical manner by Tabanidae.

(329) Cross (H. E.). **Experiments on the Treatment of Surra in Camels.**—*Memoirs Dept. Agric., India.* Veterinary Series. 1914. Sept. Vol. 2. No. 6. pp. 155–198. With 2 figs.

This paper contains an account of the experiments carried out with the following six methods of treatment :—*

1. One dose of soamin followed by gradually increasing doses of arsenious acid ; the treatment being commenced when the trypanosomes were present in the peripheral blood.
2. As above, but treatment started when the trypanosomes were absent from the circulation.
3. Gradually increasing doses of arsenious acid ; treatment being started when the trypanosomes were present in the blood.
4. As No. 3, but started when trypanosomes were absent from the peripheral blood.
5. Combination of soamin, tartar emetic, and arsenious acid ; treatment being started when trypanosomes were present in the blood.
6. Soamin and arsenious acid given alternately, with one day interval between each ; treatment being started when trypanosomes were present in the blood.

As a preliminary investigation a number of experiments were made to ascertain the minimum lethal dose of arsenious acid when administered intravenously.

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*Reference to the list of treatments given at the commencement of the paper appears to indicate that there has been a little confusion in the numbering of treatments 3 and 4, as in the detailed statements of the experiments under these numbers the factor regarding the presence or absence of trypanosomes at the time when treatment was started appears to have been reversed. The numbering given in the original has been followed in this abstract.

The tolerance of the camel for arsenious acid is very variable and consequently each case has to be treated upon its merits to some extent. It was found, however, that as a general rule 1·2 grammes per 1,000 lb. body weight can be safely given, but in some cases larger doses (1·7 gm.) were tolerated.

The arsenious acid was used in every case in a 1 per cent. solution dissolved in alkali. Tartar emetic was also administered in a 1 per cent. solution. The solutions were filtered and injected at 37° C. by means of Ehrlich's injection flasks.

In treating cases of colic large doses of chlorodyne (3 to 4 ounces), containing 1 grain of hydrochloride of morphia to the ounce, should be administered. In cases of unsteadiness 2 grains of strychnine should be given subcutaneously.

A liberal diet should be allowed during and after treatment.

Treatment 1.—The dose of soamin used was 100 cc. of a 5 per cent. solution and the dose of arsenic ranged from 0·4 gm. to, in some cases, over 2 gm., about 10 doses of arsenic being given, and one day elapsing between consecutive doses.

In all, 21 animals were treated. In 12 cases there were relapses, in two cases the animals died, and in the remaining seven cases there was no relapse recorded for periods varying from 111 to 281 days. The percentage of animals in which no relapse was recorded was 33.

Treatment 2.—Nine animals were subjected to this method of treatment. In two cases there were relapses, in two instances the animals died, and in the remaining five no relapses were recorded for periods varying from 95 to 281 days.

In this case 55 per cent. of the animals did not show any relapses.

Treatment 3.—Arsenious acid alone was administered in doses increasing from 0·4 gm. to 2 gm. or more, there being, as before, an interval of a day between consecutive doses.

The following table summarises the results obtained by this method :

Number of animals treated ..	12	
Cases in which relapses occurred	4	
Number of Deaths	1	
Cases in which no relapse occurred	7	(122–277 days under observation).

Treatment 4. The same as No. 3, but started when trypanosomes were present in the blood.—

Eight animals were treated by this method. In four cases there were relapses, and in the remaining four no relapses were recorded for periods ranging from 121–178 days.

Treatment 5. Combined soamin, tartar emetic, and arsenious acid.—

These drugs were given on three consecutive days and then repeated three times with intervals of two to six days. The doses of soamin and emetic was 100 cc. of a 5 per cent. solution (and in a few cases 6 or 7 per cent.) and 0·5 gm. respectively. The dose of arsenic was gradually increased from 0·5 to 1·2 gm.

The tabulated results are as follows :—

Animals treated	24	
Cases in which relapses occurred	9	
Number of Deaths	1	
Cases in which no relapse occurred	14	(73 to 379 days under observation.)

Percentage of cases in which no relapses were recorded—58 per cent.

Treatment 6. Soamin and arsenious acid given alternately.—The soamin was given in a 5 to 7 per cent. solution, and the arsenious acid in doses increasing up to a maximum of 1·5 grammes. Included among these experiments are some in which the treatment was continued by arsenious acid alone after some doses of soamin had been administered.

Fifteen animals were included in this group. In four cases there were relapses. In one death occurred, and in the remaining 10 (66 per cent.) no relapses were recorded in from 80 to 279 days.

The conclusions drawn may be summarised as follows :—

There is no necessity to wait for the appearance of trypanosomes in the circulation before commencing treatment. This is of importance because sometimes the intervals between paroxysms last for weeks and time is thus saved.

No case should be considered as cured until it has been under observation for a year without a relapse occurring.

Soamin should not be used in solutions stronger than 5 per cent. as there is a danger of producing nephritis. While cures can be effected without increasing the doses of arsenic to the subtoxic dose, the dose should be increased till the sub-tonic dose is reached, the principle of the treatment being the sterilisation of the tissues.

In the combined treatment, the dose of arsenic must not be so large as when it is given alone or when alternated with soamin.

As the tolerance of the camel to arsenic varies from animal to animal and the virulence of the trypanosome varied in different outbreaks, the same percentage of cures cannot always be obtained.

Good feeding is essential.

(330) Ciuca (M.). **L'Action de quelques Substances Médicamenteuses sur le Pouvoir Alexique du Sérum.** [The Effect of Certain Medicinal Substances upon the Alexic Power of Serum.]—*Bull. Soc. Path. Exot.* 1914. July. Vol. 7. No. 7. pp. 626–632.

The experiments detailed in this paper were carried out during the course of an investigation into the mechanism of the action of emetic upon trypanosomes.

Reference is made to the observations of Fenyvessy and Freund, who found that while the intravenous injection of calcium chloride increased the alexic power of the serum, the opposite effect was produced when the drug was added to serum in vitro.

The observations of Weil and Dufourt and of Weisback are also referred to. These authors found respectively that the intravenous injection of 2 to 4 cc. of a 4 per cent. solution of bicarbonate of soda causes an increase in the alexic power of the serum, both in man and in rabbits, and that salvarsan produces an accelerating effect upon haemolysis in vitro and particularly upon the alexin.

So was unable to detect any influence upon the alexin when rabbits were injected subcutaneously with atoxyl.

The author's experiments have been carried out upon rabbits, guinea-pigs, and rats, both normal and infected with the Uganda strain of Nagana

The experiments were carried out in the following way :

The rabbits and guinea-pigs were injected intravenously and the rats intraperitoneally with emetic in the proportion of 1 to 5 mgm. per 100 gm. body weight, atoxyl in doses up to 2 mgm. per 100 gm. and salvarsan 1·5 mgm. per 100 grammes.

The animals were either bled to death half an hour afterwards or they were bled on a number of occasions at variable intervals. The results of the experiments are set out in a number of tables.

It was found that the intravenous injection of emetic or salvarsan into healthy animals caused an elevation of the alexic power, while atoxyl produced the opposite results. The latter effect was far more marked than the opposite effect produced by emetic and salvarsan. That the effect was due to an action upon the alexin is shown by the fact that heating all the sera to 56° C. inactivated them. The effect could be observed for 48 hours after the injection.

With regard to animals severely affected with trypanosomiasis, it was confirmed that at the height of infection alexin is generally quite absent from the serum, but in these animals when treated with emetic or salvarsan the increase in the amount of alexin was particularly marked. Such sera were able to activate systems which could not be activated by sera from non-infected animals three hours after the treatment.

Atoxyl decreases the alexin in non-infected animals, but increases it in infected animals, but to not so great an extent as the other two drugs.

Among healthy rabbits and rats the alexin is sometimes particularly susceptible to the action of chemical salts.

In the earlier experiments the control serum was taken from an animal before the injection of the drug. The inconclusive and sometimes inconstant results were due to a diminution in the amount of alexin following on the previous bleeding.

In some of the experiments the alexin was found to have fallen to a quarter of the normal titre when an animal was bled twice on the same day or on two consecutive days.

The increase in the alexin is associated with and follows the intense leucocytosis produced by the injection of the drugs.

The fall in the amount of alexin produced in healthy animals by atoxyl is probably due to the affinity of this drug for the albumens of the body, this being essential to render it active (Levaditi and Yamanouchi). It is quite possible that in animals infected with trypanosomes the product which is formed in the body has an action comparable to that provoked by salvarsan and emetic.

(331) Laveran (A.) & Roudsky (D.). **Sur un Dérivé du Diamino-arsénobenzène.** [A Derivative of Diaminoarsenobenzene.]—*Bull. Soc. Path. Exot.* 1914. July. Vol. 7. No. 7. pp. 593–596.

The substance described in this paper has been prepared by Oechslin and has been named O 1. It is said to possess the following advantages over arsenophenylglycin, which it closely resembles in its action in trypanosome diseases.—

The drug is far more stable. It occurs in the form of a pale yellow powder which is easily soluble in water. It is far cheaper to prepare and does not undergo rapid alterations when sealed up in tubes, even

when the tubes contain a small amount of air. A watery solution is said to remain unchanged in sealed ampoules for periods varying from eight days to a month. It is less toxic than arsenophenylglycin A healthy mouse weighing 20 grammes will withstand a dose of 10 mgm. whereas a dose of 8 mgm. of arsenophenylglycin would suffice to produce a fatal effect. As animals infected with trypanosomes are more susceptible to the action of drugs than healthy ones, the dose for an infected mouse must not exceed 5 mgm. For a guinea-pig weighing 500 grammes (whether infected or not is not stated) the dose is 5 cgm., and for a dog weighing 10 kgm., 25 cgm.

No danger attaches to repeated treatments with 0 1. Sub cutaneous injections produce painful oedematous swellings, and sometimes gangrene of the skin, but a 4 per cent. solution in distilled water has been injected into the saphena vein of dogs without ill effects.

Sterilisation in the autoclave increases the toxicity of the drug, and the authors have resorted to filtration for the sterilisation of solutions destined for intravenous injection.

The subcutaneous injection of 5 mgm. into mice heavily infected with *T. brucei*, *T. rhodesiense*, or *T. dimorphon* has caused the disappearance of the trypanosomes within a few hours. Cures have been effected by this treatment and also by three injections of 2 to 3 mgm.

In the dog and the guinea-pig it is easy to cause a disappearance of trypanosomes from the circulation, but the authors are not in a position to state whether relapses occur, and in what proportion of cases.

A cure has been effected in the case of a guinea-pig infected with a strain of *T. gambiense* resistant to atoxyl.

Neither the composition nor the method of preparation of the drug is given.

(332) Levaditi (C.) & Mutermilch (St.). **Amboceptеurs et Arsénobenzol.** [Amboceptors and Arsenobenzol.]—*Bull. Soc. Path. Exot.* 1914. July. Vol. 7. No. 7. pp. 633–640.

The authors have prepared three kinds of sera in the following ways: (*a*) Serum from normal rabbits treated with "606." (*b*) Serum containing trypanolytic amboceptor from infected rabbits killed after the crisis. (*c*) Serum possessing the characters of the two preceding from infected rabbits which have been treated with "606" after the crisis.

These three sera were used for the treatment of infected mice.

Eight experiments have been carried out in this way, and in five of these constant results were obtained.

Comparison of the results obtained shews that what may be called the "606 alone" serum does not exercise any marked effect upon the multiplication of the trypanosomes, nor does it delay death very much. The serum containing only amboceptor exercised a very feeble effect, all the mice dying with trypanosomes in their blood. On the other hand the serum from the rabbits treated with "606" which also contained amboceptor prevented the multiplication of the parasites, the mice which received the largest doses of this serum shewing no

trypanosomes in their blood during the whole course of the experiments which lasted from 22 to 37 days.

In three of the experiments the results obtained were, however, different, in that the "606 alone" sera used in these experiments were themselves active, so that the beneficial effects of combining amboceptor with "606" were less apparent.

Having established the superiority of the sera combining the two active properties, the next step taken was to ascertain the trypanocidal action of the three sera in vitro.

The experiments were repeated several times with constant results. Two striking facts were ascertained.

(1) If the trypanocidal effect of the amboceptor + "606" complex is compared in vitro with the trypanocidal action of each of the components, the effect of the former is not found to greatly exceed the effects produced by the latter. Thus, in one instance the complex was found to be completely effective in 1 in 500. In this case the amboceptor alone was effective in the same strength and the "606 alone" was effective in 1 in 100.

From this it follows that in vitro the trypanocidal action of the amboceptor is not added to the trypanocidal action of the arsenic compound. If that were the case the complex should exceed either of the components in activity. It must therefore be concluded that amboceptor and "606" do not act upon the trypanosomes in the same manner. In EHRLICH'S terminology, the arsenic receptor is different from the receptor acted upon by the trypanolytic antibody.

(2) "606 alone" serum exercises markedly different effects in vitro and in vivo. While in the majority of cases this serum when injected almost at the same time as the trypanosomes, but at a different part of the body, did not prevent the evolution of the infection nor a fatal termination, in vitro it caused the destruction of the trypanosomes.

This difference of action can only be explained on the supposition that new properties are acquired by the "606" when it is subjected to the action of the cells and fluid of the body. It is probable that its diffusibility is altered and also its affinities for the tissues.

It is quite another matter when the arsenic compound is present in the serum in association with amboceptor. The results obtained in vitro and in vivo force one to the conclusion that in the animal body the action of one of the components of the complex assists the action of the other. Further, it appears that the two trypanocidal agents acting upon the two sets of receptors should render relapses of arsenic and antibody-resistant strains less likely and thus lead to complete sterilisation. Arsenic-fast individuals will be subjected to the toxic influence of the antibody trypanocides and vice versa. These facts may have important practical consequences.

The authors have the idea that in sera containing the "606" and amboceptor these two substances are associated with the same protein molecule, but they have not been able to get experimental results plainly indicating this. All that they have been able to shew is that the arsenical compound and the amboceptor cannot be separated by dialysis through collodion sacs, and further, that precipitation of the albumins and globulins does not lead to distinct separation. Though this suggests that the attachment may be to the same protein

molecule, a simple explanation, it is admitted that the experimental facts could be explained in another manner, such as simple absorption and physical inclusion of the arsenic compound by the precipitates.

Whatever may be the real explanation, the fact remains that the results obtained indicate a line which may have valuable practical results.

(333) Jack (R. W.). **Tsetse Fly and Big Game in Southern Rhodesia.** —*Bull. Entomol. Research.* 1914. Sept. Vol. 5. No. 2. pp. 97–110. With 2 maps.

This paper contains an account of the investigations of the author regarding the connection between *G. morsitans* and big game. During the last four and a half years he has visited the great majority of the fly-belts in the territory, and the main belts have been visited repeatedly. The broad result of the observations is that game is more or less abundant all the year round in the fly-infested country, and that in no instances is the larger animal life absent, even during a portion of the year. The evidence collected is considered to be strongly in favour of a vital association between the prevalence of big game and the continuance and increase of the fly.

The evidence in favour of the necessity of big game to the tsetse in Southern Rhodesia and the adjacent territory may be summed up under four heads:—

1. Tsetse retired before the advance of civilisation in the Transvaal, the only known modification of conditions being the destruction of game.
2. Tsetse disappeared from large tracts of country immediately after the rinderpest epizootic of 1896.
3. Tsetse has increased and spread since the rinderpest only in those parts of Southern Rhodesia where big game has increased.
4. Tsetse has greatly decreased of late years in the Hartley District in those parts where big game has been most effectively destroyed or driven away.

LEISHMANIASIS.

(334) Row (R.). **Experimental Leishmaniasis in the Monkey and the Mouse induced by the Parasites in Culture.**—*Indian Jl. Med. Research.* 1914. Apr. Vol. 1. No. 4. pp. 617–621. With 2 coloured plates.

This paper contains an account of experiments in which susceptible animals were infected with cultures of *L. donovani*, and of *L. tropica*. The principal object in recording the experiments is that they afford an easy means of testing the infectivity of this or that intervening host which may be brought forward from time to time as *the* agency responsible for the transmission of the disease to man.

A.—Kala azar culture experiments.—

The success or failure of experimental infection with cultures appears

to depend on the susceptibility of the animal used, the age and morphological phase of the parasite in culture, and the method of infection.

The smaller race of *Macacus sinicus* found in the neighbourhood of Madras is more susceptible than the larger race from the Bombay district, and this animal appears to be the subject *par excellence* for experimental purposes.

The author has not had any successes in attempting to infect dogs, although LAVERAN working with the same strain has infected three out of eight.

The author's observations have convinced him that positive results are only obtained when the cultures contain large numbers of small rounded bodies resembling the original parasites, or small coccus-like bodies which look like "fused condensed nuclei of the parasites enveloped in a mere suspicion of a zone of body protoplasm."

These results differ from those obtained by NICOLLE, MANCEAUX, LAVERAN, and GONDER, who have only obtained positive results by using young active flagellates.

Intraperitoneal inoculations if successful always produce a generalised infection, while subcutaneous inoculation leads to a localised lesion not followed by generalisation, or generalisation preceded either by a very slight localised lesion or none at all.

B. Oriental Sore culture experiments.—

The author states that, while he has been able to infect monkeys experimentally with *Leishmania tropica* from cases of Cambay sore, he has never been able to infect them with cultures of the parasite. NICOLLE and others have recorded successful inoculation of the monkey with the production of a local lesion, and GONDER has recorded infection of the spleen and liver in an inoculated mouse, with localisation at a later period.

The author has subjected a mouse to the following inoculations :—

1st injection	intraperitoneally	9–4–13, 0·5	cc.,	7 weeks	old culture.
2nd ,,	,,	10–4–13, 0·25	cc., 4	,,	,,
3rd ,,	,,	11–4–13, 0·25	cc., 4	,,	,,
4th ,,	,,	11–6–13, 0·25	cc., 6	,,	,,

All the cultures were rich in rounded forms and contained hardly any motile forms.

The animal remained alive and apparently healthy until it was killed 9 months and 13 days later.

At the post-mortem the spleen was six to eight times the normal size and the liver was also somewhat enlarged. The peritoneum and the other organs appeared normal. Smears from the liver, spleen, and bone marrow showed an exceedingly rich infection, and cultures yielded pure flagellates. In smears made from the heart blood large coccus-like bodies were found in the red corpuscles. These bodies were not cocci, as they would not grow upon agar.

These facts show that, like *Leishmania donovani*, *Leishmania tropica* in culture produces a generalised infection in the mouse, while kala azar cultures administered subcutaneously produce a local lesion, or a generalised infection, or both.

The question arises whether the parasites are identical and the author expresses the hope that further experiment will throw light upon the subject.

(335) KORKE (V. T.). **A Note on the Production of Localised Lesions by *Leishmania donovani* in *Macacus sinicus*.**—*Indian Jl. Med. Research.* 1914. Apr. Vol. 1. No. 4. pp. 622–625.

This short paper contains brief details of a number of experiments carried out to check ROW's results regarding the production of localised lesions in monkeys with *Leishmania donovani*.

The conclusions arrived at are as follows:—

"1. In *Macacus sinicus*, *Leishmania donovani* is capable of producing purely localised lesions which take the form of nodules.

"2. Injecting infective material into pockets of skin on the foreheads of monkeys is an effectual and easy way of producing such lesions. Such a procedure may at times give rise to a systemic or generalised infection.

"3. The incubation period of these nodules varies between 52 and 71 days.

"4. The Leishmania contained in such nodules are capable of giving rise to similar lesions in other monkeys. They appear in typical form as well as mononuclear round bodies. Occasionally parasites in these nodules are very small though typical in other morphological respects."

(336) MACKIE (F. P.). **Kala azar in Nowgong (Assam).**—*Indian Jl. Med. Research.* 1914. Apr. Vol. 1. No. 4. pp. 626–662. With 6 maps and 6 charts.

This paper is a report of the work done during the period February to September, 1912. It is interesting to note that no connection was traced between the disease in man and its occurrence in the dog or any other species of animal.

(337) PATTON (W. S.). **The Behaviour of the Parasite of Indian Kala Azar in the Dog Flea, *Ctenocephalus felis*, Bouché, with some Remarks on Canine Kala Azar and its Relation to the Human Disease.**—*Indian Jl. Med. Research.* 1914. July. Vol. 2. No. 1. pp. 399–403.

The material examined was obtained from about 200 fleas which were fed upon a dog infected with the human parasite during the four days preceding its death. Four days before death about 500 parasites could be found in every smear of peripheral blood, and two days before death there were about 1,000 parasites in every such film. In Madras the dog flea is *Ctenocephalus felis*. *Ctenocephalus canis* is found on the jackal only.

The fleas were dissected at varying intervals after the meal of infected blood, and it was found to be exceedingly difficult to find parasites eight hours after the meal, and none were found in the fleas dissected at later intervals.

The conclusions drawn are as follows:—

"1. The parasite of Indian kala azar does not develop in the dog flea, *Ctenocephalus felis*, but degenerates and disappears in eight hours. This together with the fact that the dog has not been found infected with kala azar, or perhaps, to be exact herpetomoniasis, in India, strongly supports the view that human kala azar is not of canine origin. The human flea, *Pulex irritans*, has not been found in Madras.

"2. Assuming that the parasites of Indian and Mediterranean kala azar are identical, it is difficult to understand why the one does not develop in the flea, while the other does.

"3. The fact that the dog may be infected with *Herpetomonas ctenocephali* suggests that the so-called canine kala azar may have nothing to do with the human disease, and that its association with it is a coincidence. There is at present no proof that either *Ctenocephalus canis* or *Pulex irritans* transmits the parasite of human kala azar from dog to man and man to dog, and the hypothesis advanced by NICOLLE and so vigourously supported by BASILE and others appears to be based on very slender evidence."

(338) SERGENT (Edm.), SERGENT (Et.), LEMAIRE (G.) & SENEVET (G.) **Insecte Transmetteur et Réservoir de Virus du Clou de Biskra. Hypothèse et Expériences Préliminaires.** [Insect Transmitting Agent and Reservoir of the Virus of Oriental Boil at Biskra. Hypothesis and Preliminary Experiments.]—*Bull. Soc. Path. Exot.* 1914. July. Vol. 7. No. 7. pp. 577–579.

Epidemiological observation does not allow of any view regarding the transmission of oriental sore at Biskra other than that it is transmitted by a biting insect, and, in view of the fact that the exposed portions of the body are the predilection seats of the boils, the insect is in all probability winged.

In 1904, the authors incriminated Phlebotomus as being the transmitting agent, and since that date other authors have published papers agreeing with this view.

Since oriental boil is a localised affection (GONDER'S view that it is a generalised disease being unproved), it is scarcely possible to hold that the human subject is the reservoir whence the insects derive the virus. A reservoir must therefore be sought among the animals which are bitten by Phlebotomus.

Phlebotomus of the group *P. papatasii* bite the human subject for preference or perhaps exclusively. But those of the group *P. minutus* normally bite reptiles.

Two species are encountered at Biskra: *P. papatasii* and *P. minutus*, var. *africanus*. The Geckonidae, which have been described by HOWLETT in India as the natural host of *P. minutus*, are very commonly found in houses in Biskra, the species being *Tarentola mauritanica*.

The authors have carried out investigations with the idea of testing the hypotheses that *P. minutus* may be the transmitting agent and the tarentola the reservoir of the virus.

The seasonal occurrence of the disease may be associated with the fact mentioned by HOWLETT that *P. minutus* only bites man during the hot season, and during the cold weather lives on the hibernating geckos.

The authors have verified the statement that *P. minutus* feeds on the tarentola at Biskra, and they have also found that it bites the human subject.

At the moment their investigations permit them to say that in nearly 16 per cent. of cases cultures made from the organs of the tarentola yield pure cultures of a leptomonas resembling the leptomonas of cultures of the organism of oriental boil. Interest attaches to this point because all the cultures of leptomonas so far obtained from the organs of vertebrates have been derived from leishmania.

(339) Archives de l'Institut Pasteur de Tunis.—1914. Aug. 1. Vol. 9. No. 1. pp. 30–38.—**Chronique de Kala Azar en Tunisie.** [Statistics of Kala azar in Tunis].

Since the publication of the last statistics eight fresh cases of leishmaniasis in the human subject have been discovered in Tunis and one case in Algeria. The majority of the cases have been found in boys under three years of age.

During the year 1913, 109 dogs which presented symptoms suggestive of infection were examined, and of these six were found to be infected.

Five strains of parasites are under cultivation. Two of these are from human sources and have reached the 100th and 56th generation respectively, two are from canine cases and have passed through 61 and 58 subcultures, and the remaining strain is from a case of oriental sore which is in the 119th generation. The reinoculations are made twice monthly on blood agar. The last of the strains was isolated in 1909, and during the period that it has been under artificial cultivation it has not undergone any change of morphology.

It has been found very difficult to maintain the canine strain by passage through dogs, and it is a curious fact that the canine strain of the parasite is less infective for the dog than the human strain.

SPIROCHAETOSIS.

(340) Wolbach (S. B.). **The Distribution and Morphology of *Spirochaeta duttoni* and *Spirochaeta kochi* in experimentally infected Ticks (*Ornithodorus moubata*).**—*Jl. Med. Research.* 1914. March. Vol. 30. No. 1. pp. 37–48. With 3 plates comprising 18 figures.

The investigations described in this paper were rendered possible by the elaboration of a special method of staining with Giemsa.

The full details of the method are given and the following are the principal points :—

The tissues are fixed in sublimate alcohol and are passed through into paraffin. Sections should be 2 microns in thickness. After complete removal of the mercury by iodine, and of the iodine by hyposulphite of soda, the sections are stained with the following dilution of Giemsa : sixty drops of stain, 100 cc. of distilled water, 10 cc. of methyl alcohol and 2 drops of ·5 per cent. sodium carbonate. The stain is replaced twice during the first hour and then left acting for 20 hours.

After staining the sections are differentiated in two changes of 100 cc. of acetone containing 15 gm. of colophonium. The process takes from 15 to 30 seconds. The sections are then passed through acetone xylol, pure xylol, and mounted in cedar oil. Uniform results have been obtained.

As a result of the examination of preparations made from experimentally infected ticks treated in this way the following conclusions are drawn :—

"1. The modified Giemsa stain employed is a reliable method of demonstrating spirochaetes in the tissues of ticks.

"2. The two strains of spirochaetes studied, *Spirochaeta duttoni* and *Spirochaeta kochi*, migrate through all the organs and tissues of the ticks.

"3. Multiplication of spirochaetes does not take place in the epithelial cells of the tick, but does occur in the tissues of the connective tissue group.

"4. The minute granules and comma bodies found in epithelial cells, and probably those in other tissues, are not stages in the development of the spirochaetes.

"5. Large granules, coiled and encysted forms derived from spirochaetes, occur in various connective tissue structures, and may possibly represent resting or multiplication stages.

"6. By virtue of the power to invade tissues, the spirochaetes studied may be transmitted in any secretory or excretory product of the ticks."

(341) Todd (J. L.) & Wolbach (S. B.). **Concerning the Filterability of *Spirochaeta duttoni*.**—*Jl. Med. Research.* 1914. March. Vol. 30. No. 1. pp. 27–36.

Following the technique employed by Novy and Knapp, Breinl and Kinghorn, the authors have repeated the filtration experiments of these authors and have arrived at the following conclusions :—

"1. *Spirochaeta duttoni* in an infective form can be forced through a Berkefeld filter by pressures of over fifty pounds to the square inch.

"2. *Spirochaeta duttoni* cannot be filtered through a Berkefeld filter, in an infective form by atmospheric pressure."

MALARIAL AND OTHER BLOOD PARASITES.

(342) Phisalix (Mme). **Sur une Hémogrégarine Nouvelle, Parasite de *Boodon fuliginosus* Boie, et ses Formes de Multiplication Endogène.** [A New Haemogregarine parasitic in *Boodon fuliginosus*, and its Endogenous Multiplication Forms.]—*Bull. Soc. Path. Exot.* 1914. July. Vol. 7. No. 7. pp. 575–577.

The snake in whose blood the parasites described in this paper were found was sent from the Soudan. It died in an extremely anaemic condition a month after its arrival.

Apart from the blood parasites the following were also found :—

On the skin *Ophionyssus natricis* and *Aponema laeve* were present, the former being in large numbers.

Numerous slender nematodes, the species of which has not yet been determined, were found in the oesophagus and in the connective tissue surrounding the viscera.

Examination of the blood showed that there was profound anaemia and that the majority of the remaining blood corpuscles had lost the greater part of their haemoglobin.

The haemogregarine was present in the peripheral and heart blood in very considerable numbers, but no multiplication forms were found in the latter. They were, however, found in the capillaries of the lungs, liver, kidneys, spleen and pancreas.

Two endoglobular forms were recognisable.

(*a.*) Vermicules measuring 14 to 15 microns in length, and 2 to 3 in width. These were slightly curved at the extremities, one of which tapered slightly. They were found applied to the nucleus of the cells, and possessed a thin unstained capsule.

The nucleus formed an elongated mass which was sometimes bilobed. It was placed close to the convex border of the parasite towards the thicker end. It was homogeneous and stained deeply. In some instances two parasites were found in a single corpuscle. The corpuscles did not appear to have undergone any alteration save an increase in size due to the presence of the parasites.

(*b.*) In a minority of cases parasites of the same length, but of three or four times the thickness, were found. In these the nucleus was rounded or annular, and composed of filaments of chromatin. These stained with moderate intensity, and in some cases there were granules scattered through the protoplasm which did not take the stain.

Free forms were represented by both of these types. In the majority of cases they were only set free by a gradual disintegration of the blood corpuscle containing them. Subsequently the parasites themselves tended to degenerate, first becoming swollen and then disintegrating. Those parasites which had previously been slender could be recognised by the slight curving of their extremities.

Cysts containing macromerozoites were encountered in small numbers in the lungs, liver, spleen, and kidneys. They were regularly ellipsoid in shape and contained 2 or 4, and rarely 6, merozoites. The smallest of these measured about 17 by 12 microns, and the largest about 30 by 20. The nuclei stained intensely, and the protoplasm very distinctly. The capsule did not stain.

Cysts containing micromerozoites were found in large numbers in the lungs, liver, and pancreas, but not in the spleen and kidneys. The youngest, corresponding to the first stages of division of the nucleus, contained 2 or 4 nuclei embedded in a granular mass. They measured about 25 by 18 microns. Those in the most advanced stage of development were packed with little ovoid nuclei measuring about 1 micron. These stained intensely. Cysts in this stage measured 30 by 25 microns. The envelope was very thin, and around a great number of them, but not all, there could be seen a retraction zone in which the parasite occupied an eccentric position.

None of the cysts were found to be in the process of rupture, and no forms of exogenous multiplication were seen.

The name *Haemogregarina boodoni* is suggested for the parasite.

(343) Acton (H. W.) & Knowles (R.). **Studies on the Halteridium Parasite of the Pigeon,** *Haemoproteus columbae,* **Celli and San Felice.** *Indian Jl. Med. Research.* 1914. Apr. Vol. 1. No. 4. pp. 663–690. With 5 coloured plates and 5 tables.

In a paper published in 1913 on the "Diagnosis of Latent Malaria," the authors suggested that the terms relapse and recrudescence should

be differentiated from each other. Relapse was defined as a biological phenomenon involving the re-formation of asexual forms from the and persistent gametes; whilst they regarded recrudescence as an resistant exacerbation of the asexual cycle.

As material from human sources was not available to afford proof of these views, experiments had to be carried out and investigations made regarding malarial infections in animals.

After having examined a number of monkeys for malarial infection without success and having found that sparrows infected with Proteosoma did not live in captivity for more than two or three days, the authors fell back upon *Halteridium columbae*, which was the only parasite analogous to *Plasmodium malariae* available.

From their studies in connection with the life-cycle of the parasite in the pigeon the authors have come to the conclusion that the description given by BEAUREPAIRE-ARAGAO is misleading, and that that given by NEGRI is correct for the mature schizont stage only. The figures given in DOFLEIN after LABBÉ are inaccurate, and in their opinion, represent the life-cycle of the Proteosoma parasite.

The details of the asexual cycle are said to be very puzzling, but the authors believe that their description of it is accurate in its essential details.

The asexual cycle.—The merozoites are small, ovoid or irregular bodies measuring about 2 microns in diameter, and consist of a small granule of chromatin with fairly darkly staining cytoplasm. They invade red corpuscles in the capillaries of the lungs and develop into trophozoites. These are oval in shape and measure from 3 to 5 microns in diameter. The chromatin is ovoid in shape and is situated near the narrower pole of the parasite. The cytoplasm stains faintly and contains very few pigment granules. They mature into schizonts.

The schizont rapidly increases in size and eventually obstructs the capillary in which it has been arrested, and the chromatin undergoes a process of fragmentation by binary fission. No pigment is observed in these stages, and in the centre of the schizont a large faintly stained mass of chromatin is seen.

The merozoites appear to escape by the bursting of the spore sac, and they carry on the asexual cycle by infecting fresh red corpuscles.

The asexual cycle appear to occur nowhere save in the lungs.

The merozoites give rise to gametes which require 6 to 10 days to come to maturity. These gametes are specially resistant forms. The author believe that only gametes are found in the peripheral blood because conditions there are not favourable for schizont formation, and that therefore young merozoites which are carried into the general circulation become gametes.

The macrogametocyte.—In this stage the parasite is elongated and it grows until it reaches the typical shape. The nucleus is centrally placed and stains a bright crimson colour. There are small light brown pigment granules scattered irregularly through the parasite.

The microgametocyte.—The young parasite is oval in shape, with a diffuse irregular orange staining chromatin mass. The cytoplasm is hyaline and stains of a faint purple colour. There may be one or two pigment granules, which are large. As the parasite increases in size the pigment granules become more numerous until 4 to 10 may be seen at each end of the parasite.

In opposition to the views expressed by CRAGG* in 1907, the authors state that (1) they have never seen intracorpuscular conjugation of trophozoites in the Halteridium; (2) The resting or "zygote" stage described by him has never been observed, but they consider the adult gamete as the resting stage and resistant form of the parasite, which alone is able to withstand injurious influences; (3) They regard the gamete as the originator of relapses.

The multiplication of the parasite in the capillaries of the lungs leads to the production of macroscopic changes in the appearance of these organs at the post-mortem, and they believe that in this fact there possibly lies an explanation of the frequency of pneumonia among malarial cachectics.

The authors believe that multiple infection of a single corpuscle is a matter of chance, and that though cytoplasmic union may occur each parasite maintains its individuality.

During the winter 1912-13, the authors spent several months trying to confirm the asexual cycle as described by BEAUREPAIRE-ARAGAO, but entirely failed to do so. The reason for this was that they were working with pigeons which had been kept for several months under good conditions, and which had only mature gametes in their blood.

Early in 1913, a fresh batch of birds was obtained and in some of these young gametes were found in the peripheral blood. The authors were then able to work out the asexual cycle in the lung as described in this paper.

This observation was so repeatedly confirmed that they are able to rely upon the discovery of young gametes in the blood as an index to the presence of mature schizonts in the lungs. Where only mature gametes are present in the blood for a number of days it is found that asexual development in the lung has ceased.

A number of experiments were carried out in which blood was withdrawn from infected birds shewing either immature or mature gametes in their blood, the number of parasites being estimated from day to day. If there was an increase in the number after the taking of the blood it was an indication that asexual multiplication in the lung had not ceased and vice versa, because when only mature gametes are present in the blood there cannot be any production of new generations in the lungs by schizogony.

Though they have not been able to ascertain any maximum period for which gametes may persist in the blood, they think that it may be for some months or perhaps longer. By virtue of their great resistance and prolonged life the gametes enable the parasite to live through the winter months and bridge the interval from one fly season to another.

The authors made a number of observations upon the sex differentiation of the gametes present, and in 6 out of 10 pigeons examined the counts seemed to shew a typical Mendelian distribution; the female being dominant and the male the recessive.

In this disease the evidence points to the spleen as being the seat of destruction of the gametes.

In endeavouring to obtain evidence that female gametes can and do give rise to asexual forms, which would explain the occurrence of relapses after long intervals when fresh infection can be excluded,

* CRAIG is obviously meant.

the authors have used BASS's method of cultivating the halteridium of the pigeon.

Examination of the blood of a very large number of pigeons convinced the authors that it is in very exceptional cases only (they found one instance) that trophozoites can be found in the peripheral blood; they therefore made cultures from blood in which only gametes could be found on a number of successive days.

The blood was drawn from the marginal vein of the wing into an equal quantity of ·85 per cent. salt solution containing 1·5 per cent. of sodium citrate. This mixture was placed in sterile tubes containing ·50 per cent. dextrose (Merck) solution in the proportion of 5 cc. of the mixture to 1–10 cc. of dextrose. The tubes were incubated in an atmosphere of hydrogen at 40°-42°C. and examined every two hours. Preparations were made from the layer of corpuscles immediately below the serum.

It appeared to be important that the blood should be allowed to cool in the syringe for a few minutes "to give the necessary stimulus to the process."

Appearances were found which indicated that asexual parasites did actually develop from the female gametes, and that these gave rise to merozoites.

In one instance an attempt was made to cultivate young gametes found in the blood to adult ones, but without success. The young gametes did not, however, assume a trophozoite-like form, thus shewing that the trophozoite-like forms which were observed in other cultures did not develop from young gametes.

The trophozoite forms appearing in the cultures were not present in the blood when taken from the bird, because control preparations shewed none, and, further, because ten out of twenty-one cultures shewed trophozoite forms, while trophozoites were only once found in the blood out of more than 200 pigeons examined.

The male gametes could not have taken part in the process as the conditions necessary for the formation of microgametes were not present and all the male parasites were observed to degenerate very rapidly in cultures and to be ingested by phagocytes.

The authors consider the change of temperature and environment form the stimulus to the female parasites to become parasites acting as trophozoites, and in this they find the explanation of the relapses occurring in malaria in the human subject, as such relapses always occur when circumstances become unfavourable to the host, and when the blood environment of the parasite (as for example when vaccines are introduced) is altered.

(344) LEGER (A.) & LEGER (M.). **Sur un Plasmodium de la Roussette du Haut-Sénégal et Niger.** [A Plasmodium of the "Flying-Fox" of the Upper Senegal and the Niger.]—*Compt. Rend. Soc. Biol.* 1914. July 24. Vol. 77. No. 26. pp. 399–401.

The authors have found parasites which they have identified with the parasite, *Pteropus gouldi*, described by BREINL in the Report of the Australian Institute of Tropical Medicine, 1911, as occurring in the Australian "flying-fox."

(345) Mackie (F. P.). **Note on the Parasite of Bat Malaria.**—*Indian Jl. Med. Research.* 1914. July. Vol. 2. No. 1. pp. 375–376. With 1 coloured plate.

The parasite described in this note was found in the blood of a flying fox (*Pteropus edwardsii*). The animal was kept under observation for several weeks without showing any symptoms of illness. The parasite closely resembled the malarial parasite of the African monkeys. The majority of those present in the blood were in the adult stage, and gametocytes were numerous. The addition of saline solution to the blood enabled the process of flagellation to be observed. The microgametes resembled those of the parasite of human malaria.

The infected animal was kept in a cage with others, but the infection did not spread.

In view of the fact that since the infected animal was found 56 others have been examined without success, it would appear that the parasite is somewhat rare. The name, *Plasmodium pteropi* (n. sp.), is suggested for the parasite.

HELMINTHS.

(346) Boynton (W. H.). **Kidney-Worm Infestation of Swine in the Philippine Islands with Special Reference to the Pathological Changes.**—*Philippine Jl. Science.* Sec. B. Trop. Med. 1914. June. Vol. 9. No. 3. pp. 269–289. With 3 plates.

The condition described in this paper is far more commonly met with in sub-tropical and tropical climates than in colder countries. It has been observed in the United States, especially in the southern part, South America, Australia, Asia, and in the Philippine Islands.

The cause of the condition is *Stephanurus dentatus*, also known as *Sclerostoma pinguicola.*

Examination of 2,000 pigs slaughtered at Manila showed that nearly 50 per cent. of the animals were affected.

The symptoms shown are: stiffness, especially of the hind limbs, the lameness and loss of power increasing progressively. There may be almost complete loss of power in the hind limbs a few days before death. The appetite is generally maintained until a few days before death.

The parasite has been encountered in a number of different situations. It occurs free upon, and embedded in, the fat surrounding the kidneys, and also within the kidney itself. It occurs free in the peritoneal cavity, in the liver, portal and mesenteric glands, and especially in great numbers in the connective tissue along the back. It has been encountered in the pleural cavity and embedded in the pleura.

It is said that in infested carcases putrefaction occurs very rapidly.

A detailed description is given of the changes produced in the organs resulting from invasion by the worm.

(347) Lane (C.). **Bursate Nematodes from the Indian Elephant.**—*Indian Jl. Med. Research.* 1914. July. Vol. 2. No. 1. pp. 380–398. With 12 plates.

The author of this paper has had the opportunity of examining material from six elephants and has found eight species of bursate worms, of which six are new and fall into six genera.

As full a description as possible is given of each, and the paper is illustrated with numerous plates.

FILTERABLE VIRUSES.

(Rinderpest and Infectious Anaemia of Horses).

(348) Boynton (W. H.). **A Preliminary Report of Experiments on the Cultivation of the Virus of Rinderpest in Vitro.**—*Philippine Jl. Science.* Sec. B. Trop. Med. 1914. Feb. Vol. 9. No. 1. pp. 39–44.

In preliminary experiments it was found that sterile blood drawn from infected animals maintained its virulence better under anaerobic than under aerobic conditions, and also that the virulence was maintained for a longer time when the blood was withdrawn within a day or two of the first rise of temperature than at later stages.

Experiments showed that neither red corpuscles, white corpuscles, nor blood platelets transmitted the disease, nor did they confer any immunity.

Investigations were then carried out to ascertain the smallest quantity of blood that would set up the disease. By the use of very fine calibrated pipettes it was found that 1/2970 cc. of virulent blood was capable of setting up the disease, but that 1/9060 failed. These data were useful in the cultivation experiments for comparison with the dilution of the original blood brought about by successive transfers in culture media.

In a number of media that were first tried it was found that the virus died in from 36 to 68 hours, but positive results were subsequently obtained with a modified form of the medium described by Nencki, Sieber, and Wijnikewitch, and with the medium used by Bass and Johns.

Nencki's medium, which consisted of 900 cc. of water containing 100 grammes of peptone and 20 grammes of sodium chloride, yielded negative results.

This medium was modified by the addition of 33⅓ per cent. solution of glucose to the peptone water in the proportion of 0·1 cc. to 10 cc. Immediately before use normal sterile defibrinated blood was added to the tubes in the proportion of 1 cc. to each tube of 10 cc. These tubes were then inoculated with 0·5 or 1 cc. of virulent blood, anaerobic conditions being produced by putting a layer of sterile paraffin oil on the surface of the medium. The tubes were incubated at 40° C. Subinoculations were made every three or four days, using sterile pipettes and transferring 0·3 to 0·5 cc.

The medium giving the best results was a modification of that used by BASS and JOHNS for the cultivation of malarial parasites. Glucose solution was added to sterile defibrinated blood taken from a susceptible animal in the proportion of 0·1 cc. to 10 cc. This medium was inoculated and then covered with sterile paraffin and incubated at 40° C.

The sixth transfer covering a period of 21 days in the blood glucose medium was found to be virulent in one instance, and in another the sixth transfer at 19 days was found to be virulent. In the salt peptone mixture inoculation succeeded with the fourth transfer at 12 and 13 days.

To ascertain whether the successful inoculations were due to original virus, calculations were made to ascertain the dilution, and in one case the virulent dose of the sixth transfer was calculated to contain 1/2,832,921 cc. of original virus. This suggests that there was an actual multiplication.

Nothing could be discovered regarding the morphology of the virus.

One animal which recovered from the disease induced by a fourth transfer is being hyperimmunised with cultures with the object of testing its serum. Experiments are also being carried out to test the possibility of devising a combined method of immunising with cultures and serum.

(349) BOYNTON (W. H.). **Experiments on the Cultivation of Rinderpest Virus as described by Baldrey.**—*The Philippine Jl. Science.* Sec. B. Trop. Med. 1914. June. Vol. 9. No. 3. pp. 259–268.

BALDREY'S paper, which was published in the *Journal of Tropica Veterinary Science*, Vol. 6, No. 1, 1911, contained an account of some experiments in which rinderpest blood was mixed with broth and incubated for 24 hours at body temperature, the liquid thus obtained being used for the hyperimmunisation of animals.

BALDREY arrived at the conclusion that an active toxin was produced in the broth, and that this toxin killed off the virus. It was found that it was best to inject the material intravenously, as if given subcutaneously it produced very severe inflammatory lesions.

The author of the present paper has repeated BALDREY'S experiments, and his conclusions, excluding references to particular experiments, are as follows:—

"1. In the case of two animals which died in less time than the incubation period of rinderpest, after injection of the Martin's broth culture, the autopsy findings of the tissues indicated death from a bacterial infection and not from rinderpest. All evidence points to the conclusion that the Martin's broth employed in these two cases was contaminated by bacteria prior to injection in the animals. The results are attributed to poor aseptic technique, and greater care in subsequent inoculations, where no such toxaemias were induced in the injected animals, support the conclusion.

"The symptoms, lesions, and other circumstances stated by BALDREY resemble the results obtained in the two animals in question, and there is justification for belief that his results were due to the same cause.

"2. In all the other animals injected with mixtures of blood and culture medium after incubation, no immediate ill effect followed in either susceptible or immune animals.

"3. With the exception of the animals noted in these experiments, all those injected with the so-called twenty-four- and forty-eight-hour cultures

of rinderpest in neutral or alkaline Martin's broth contracted rinderpest after the usual incubation period and died. These observations do not support BALDREY'S belief that there occurs a rapid formation of rinderpest toxin in the broth during the twenty-four hours with the resulting death of the virus. The experiments have included tests of Martin's broth after incubation as long as seventy-two hours.

" Rinderpest virus does die in Martin's broth culture after incubation for seventy-two hours, but there is no evidence that rinderpest toxin was formed, much less that rinderpest toxin caused the death of the virus.

" 4. The experiments reveal the fact that rinderpest virus will survive in neutral or alkaline Martin's broth at 37°C. for at least forty-eight hours, but not for seventy-two hours. Two cases were tested at twenty-four hours, 2 at forty-eight hours, and 3 at seventy-two hours.

" 5. Rinderpest virus kept in acid Martin's broth or in 5 per cent. potassium citrate solution did not survive after forty-eight hours at 37°C."

(350) BOYNTON (W. H.). **An Atypical Case of Rinderpest in a Carabao.**—*Philippine Jl. Science.* Sec. B. Trop. Med. 1914. Feb. Vol. 9. No. 1. pp. 45–47. With 1 chart.

The facts regarding the peculiar case of rinderpest described in this article are summarised in the conclusions and are as follows :—

" 1. From the facts of this case, the evidence is conclusive that an animal may experience a fatal attack of rinderpest without the occurrence of a rise in temperature.

" 2. The blood of the carabao was shown to be infected within forty-eight hours after it was originally injected with virulent blood.

" 3. It was shown that the blood was virulent on the eleventh day when injected into a susceptible animal, yet exposure to the same animal from which blood was drawn did not cause rinderpest in the exposed susceptible animal.

" 4. With regard to the three animals which failed to contract rinderpest by exposure, the question is raised as to whether rinderpest spreads by contact readily in the later stages of the disease or whether the disease must necessarily be accompanied by a rise of temperature before it can spread by contact."

(351) WARD (A. R), WOOD (W. F.) & BOYNTON (W. H.). **Experiments upon the Transmission of Rinderpest.**—*Philippine Jl. Science.* Sec. B. Trop. Med. 1914. Feb. Vol. 9. No. 1. pp. 49–78. With 2 plates and 6 charts.

The experiments described in this paper were designed to supply answers to the questions as to the period for which the virus can retain its vitality outside the body under varying natural conditions, and also the period during the course of the disease in which the virus is disseminated by sick animals.

The following conclusions were arrived at :—

" 1. Rinderpest virus was not shown to have survived beyond twenty-four hours in corrals bare of vegetation but containing water. The conditions under which the tests were made included all seasons of the year, with accompanying variation in sunlight, rain, and condition of the soil. The amount of shade varied widely.

" 2. Animals in such corrals became infected with rinderpest within half an hour, twelve hours, and seventeen and one-half, respectively, after the removal of the sick.

" 3. Animals infected with rinderpest were shown to be capable of transmitting the disease to sasceptible animals by close contact only during the febrile period of the disease, and most certainly during the period when the temperature was declining. The disease was not contracted

by susceptible animals when exposed to sick animals during the convalescent stage when the temperature was nearly normal.

"4. Blood of animals infected with rinderpest was shown in two cases to be infected during the height of the febrile period.

"5. The virus in urine, diluted with water and sprinkled on grass, was demonstrated to survive for thirty-six hours in some instances, but not always, and not for a longer period of time.

"6. Faeces mixed with water and sprinkled on grass infected an animal twenty-four hours later.

"7. Faeces and urine diluted with water and kept in a vessel in the shade remained infective for susceptible animals for thirty-six hours, but no longer.

"8. No evidence was secured to show that recovered cases transmit the disease.

"9. The foregoing facts indicate that the virus of rinderpest perishes soon after being discharged by the infected animal.

"10. Nothing in the foregoing experiments indicates that rinderpest virus is harboured for long periods upon the soil of contaminated areas."

(352) **Report on the Results obtained by the Special Committee for the Investigation of Infectious Anaemia among Horses.**—The Horse Administration Bureau. Tokyo. 1914. pp. 1–59. With 9 plates, 3 charts and 1 map.

The Special Committee, whose report this is, was appointed by the Japanese Government for the investigation of pernicious anaemia in horses in 1909. The personnel of the committee included representatives of the Horse Administration Bureau, the Imperial University at Tokyo, the Department of Agriculture, and the Army Veterinary Service.

Although exact information was not obtainable, it appears to be probably that infectious anaemia among horses was unknown in Japan prior to 1895.

The disease seems to be confined to Hokkaido, the northernmost island, and the north eastern part of Hondo, the main island. The southern portion of Japan is not invaded, because this portion of the country contains no pasture land, and it is among horses at pasture that the disease spreads.

Exact information is also lacking regarding the annual losses from the disease. In the first year of any outbreak the number of cases is small. This is followed by a progressive increase during the following years until the disease may be so severe that the majority of the horses in the district die. The disease then slowly dies down again. Once infected a district remains infected for a number of years, cases having been recorded in some districts for more than ten consecutive years after the initial outbreak.

In 1907, it was recognised that a number of deaths among the horses belonging to the Remount Depôt, which had been attributed to other causes in previous years, were in reality due to infectious anaemia. The maximum losses occurred in 1910 when a total of 500 horses died or were killed. Since that date the number of cases has decreased as a result of the preventive measures put into force. Since the virus is generally introduced by two-year-olds which have every appearance of being healthy at the time of purchase, but which afterwards prove to be infected, complete success in stamping out the disease among the remount animals has not yet been achieved, and fairly heavy losses still occur.

It is while horses are at pasture that the majority contract the infection, animals very rarely becoming infected in stables. Unless death occurs soon after infection, the disease takes a chronic course. During the first few months after infection repeated febrile attacks occur, but in cases in which the animal survives these gradually decrease in severity and finally cease.

The virus was found to be capable of passing through a Berkefield filter, and all attempts to cultivate it outside the body failed. Experimental inoculations shewed that the virus is present in the blood and all the organs, and also in the urine and milk, but attempts to prove its presence in the faeces and sweat of infected animals failed.

That the virus is protozal rather than bacterial in nature is indicated by the fact that the addition of 2·5 to 5 per cent. of sodium taurocholate to infective blood rendered it incapable of setting up the disease by inoculation.

Heating the virus to 60°C. for an hour was found to destroy its virulence. Exposure to bright sunlight (August) for two hours was also found to effect its destruction. Blood exposed out of doors from December to April, during which time the temperature was often as low as −9°C., was proved to have retained its virulence.

Blood was drawn from 21 horses at periods varying from 3 to 22 months after recovery and injected into healthy animals. All became infected with the exception of two which had received blood from horses which had recovered for three and thirteen months respectively. That these two animals were actually infected, although their blood failed to set up the disease, was proved by the inoculation of healthy horses with materials obtained from various organs when the animals were killed. Further experiments shewed that the blood may retain its virulence for periods ranging up to four years, but that the degree of virulence gradually diminishes.

Experiments were carried out to test the relationship between affected parents and their offspring with regard to the disease.

Blood drawn from four foals, the produce of infected mares, was injected into four healthy horses; one became infected, in two the symptoms produced were doubtful, and in the remaining one the result was negative. The injection of 30 to 100 cc. of milk from infected mares proved successful in three instances, but the milk of infected animals failed to set up the disease by ingestion.

That the progeny of infected mares do not acquire the infection through the medium of the mare's milk was proved by the fact that the intravenous injection of blood from a foal before it had sucked its dam set up the disease.

From this it is concluded that the infection is transmitted hereditarily.

In the donkey the disease generally follows an acute course and death takes place suddenly.

Among species of animals other than the equine the pig is the most susceptible to the virus. In the young goat and sheep a slight febrile condition is produced, but calves, dogs, rabbits, guinea-pigs, and rats are insusceptible.

Details of three experiments with pigs are given.

In the first the subcutaneous inoculation of 10 cc. of virulent blood was followed on the 11th day by a rise of temperature to 40·2°C.

There was interference with locomotion, loss of appetite, acceleration of the heart, frequent shivering fits and, finally, unconsciousness and death.

The second pig inoculated died suddenly during a febrile attack on the fifth day.

The third pig was inoculated with 10 cc. of virulent blood, but failed to shew any evidence of infection. A month later 20 cc. of its blood set up infection in a horse, proving that the virus had been in the pig for that period.

As already mentioned, infection occurs almost entirely while horses are at pasture, very occasional cases occurring in the stable. Experiments were therefore carried out to investigate the following points: Infectivity of the excreta of infected animals; infection through the alimentary canal; infection in the stable; and infection at pasture.

Experiments shewed that the disease could be transmitted by inoculation with infected urine, but no evidence was obtained that the virus was contained in the faeces.

It was also found that the disease could be produced experimentally by the administration of large quantities of infected urine (100 to 200 cc.) by the mouth.

A number of experiments in which 11 healthy horses were stabled with infected animals proved that infection in the stable is of rather rare occurrence. These experiments were carried out during the winter when there were no flies.

Principal importance attaches to the spread of the disease at pasture and in this connection the following points were investigated: The persistence of the virus in pasture during the winter; the manner in which infection occurs when healthy and diseased animals are kept together at pasture; and the relationship of blood-sucking insects to the disease.

In connection with the first of these points experiments shewed that it was quite safe to put healthy horses on to a pasture where numerous cases had occurred during the previous years, but that if healthy horses are pastured with diseased animals or animals that are carriers of the virus there is a very great risk that the healthy animals will become infected. In fact, in the experiments quoted the healthy horses contracted the disease in every instance. The shortest period of incubation was 16 days.

Although the virus is contained in the urine, it requires a large dose of this to produce infection experimentally and, further, the greater part of the urine passed soaks into the ground, that remaining on the top being disinfected by sunlight. Urine can therefore be excluded as the source of infection. This is also indicated by the fact that in stables, where the quantity of excreta is greater than in the open, the disease is far less commonly encountered.

To test the question as to whether blood-sucking insects play any part in the transmission of the disease a number of experiments were carried out.

In two experiments infected horses were kept with healthy ones in insect-proof enclosures for a period of some months. Two out of four healthy animals became infected from one diseased horse kept with them, and in the other experiment one out of two healthy horses

became infected when kept with four animals which were in a very advanced stage of the disease.

This proved that the disease could be transmitted without the agency of insects, provided the place in which the animals were kept was highly infected, but the rate of infection could not be compared with what occurs in the open pasture.

In the second series of experiments healthy and diseased horses were kept separate from each other in fenced areas separated from each other by a distance of about 15 yards. The animals could not mix with each other, but insects could pass freely between the batches.

Three experiments were carried out on these lines. In the first, nine infected horses were kept in one enclosure while four healthy animals were kept in the adjacent one. All the healthy animals contracted the infection.

In the second experiment five infected animals were placed in one enclosure. Two of these died shortly afterwards; one had a severe attack, and in the other two the symptoms were not very marked. Two healthy horses were kept in another enclosure during the whole season without becoming infected, but three out of four healthy animals placed in another enclosure, two at a time, became infected.

The second experiment was repeated the following year with the exception that nine infected animals were used instead of five. In this instance all the healthy animals contracted the disease.

From these experiments the conclusion is drawn that the disease can be transmitted without actual mixing of the diseased and healthy animals, and under conditions which exclude the intervention of insects other than those capable of flying.

Experiments with flies, ticks, etc.

Ticks.—Experiments showed that ticks taken from diseased horses and placed upon healthy horses never transmitted the infection.

Bot-flies.—These are not blood-sucking insects, but to exclude the possibility of the virus being taken into the stomach with the larvae, a number of the latter were taken from the stomach of a diseased horse, crushed in a mortar, and injected into healthy animals. In no instance was the disease transmitted. Further, it is stated that during one year bot-flies were exterminated from all the horses before pasturing, and it was noticed that this had no effect upon the prevalence of the disease.

Mosquitoes can be excluded, as they are found in the stables only, and not on the pastures.

Experiments showed that although sand flies are energetic blood-suckers they are not capable of transmitting the infection.

Negative results were also obtained in experiments in which *Stomoxys calcitrans* was used.

Tabanidae.—These flies are most abundant on the pastures, and energetically attack horses, and particular mention is made of the fact that the spread of the disease coincides with the appearance of this insect. It was found that the flies could not be kept alive for any length of time after they had been caught, and also that they could not be got to suck blood from the animals under experimental conditions.

Although direct proof is not forthcoming, the Committee feel compelled to conclude that the disease is spread through the agency of these flies.

Several species of horse-fly occur on the pastures where the experiments were carried out. The principal ones are the following:— *Chrysops japonicus, Haematopota tristis, Tabanus chrysurus, Tabanus trigonus, Tabanus trigeminus, Tabanus luridus, Tabanus rufidens,* etc.

The lesions present in cases of the disease vary in degree according as the case is acute or chronic, but not in character. They are typically those of anaemia, and in chronic cases there is marked emaciation. The visible mucous membranes are pale, and frequently ecchymosed. The subcutaneous and intramuscular connective tissue contains a gelatinous or blood-stained exudate. The muscles are soft, and pale in colour. The alimentary tract shows no lesions save for catarrh in some cases.

In acute cases, or after several attacks, the spleen may be two or three times the normal size. The capsule may show petechiae, and the pulp presents an appearance resembling that seen in cases of anthrax. In chronic cases the spleen is enlarged and firmer than normal. The capsule of the liver shows white patches of varying size and shape, these being particularly numerous between the lobules.

In acute cases the kidneys are enlarged and softened, and covered with small petechiae.

The lungs do not show any changes peculiar to the disease save oedema, but in some cases there is broncho-pneumonia.

The blood is very watery and greatly reduced in amount. The lymphatic glands, both of the carcase and of the viscera, are enlarged and oedematous, and of a reddish brown colour.

Histological examination reveals changes corresponding to the lesions: Anaemia, extravasations, degenerations of the parenchymatous organs, and the presence of haemoglobin crystals. Special mention is made of an infiltration of small round cells into the parenchymatous organs.

The prominent symptoms of the disease are the irregular occurrence of fever and progressive anaemia. In the majority of cases the fever recurs several times in a month, but sometimes periods of a few weeks up to six months elapse between consecutive febrile attacks.

At the onset of the disease the temperature generally rises suddenly to 39° or 40° C., and after remaining at that level for a day or two suddenly falls again. In chronic cases the temperature remains for some time at a subfebrile level.

During the febrile attacks the pulse rate may be as high as 90 per minute, but it maintains a moderate strength. In the last stages the pulse may be 120 and very weak. Very slight exertion causes an acceleration of the pulse and an increase in the force of the heart beats. Pulsation of the jugulars, which may extend half way up the neck, is frequently seen.

There are little or no disturbances in connection with the lungs, save that exertion causes a distinct acceleration of the respirations, and towards the end froth may be passed through the nostrils owing to oedema of the lungs.

During the febrile attacks there is always albumen in the urine, the

maximum being 10·5 per cent. During remissions and in chronic cases no albumen is found.

In severe or chronic cases the blood clots very slowly, in some cases several days elapsing before the process occurs.

Very few changes are observed in the morphology of the red blood corpuscles. There is a reduction in the number of white corpuscles, but this is not proportional to the decrease observed in the red corpuscles.

All attempts to discover a means of diagnosis apart from clinical methods and the experimental inoculation of susceptible animals failed. A similar result attended all efforts to find a drug which would influence the course of the disease.

Immunisation.—Seven recovered horses were treated with increasing doses of virulent serum and virulent blood in doses of from 2 cc. to 4,000 cc. at intervals of three to six days. Three of these animals survived the treatment, two died of the disease during the course of the immunisation, and in the remaining two cases treatment had to be stopped owing to the development of swellings at the seat of inoculation.

The serum from these immunised horses was found to be of no value as a protective agent, but actually a source of danger, as it was proved to contain the virus of the disease, and to be capable of setting up infection in healthy horses.

It was further found that if the material used as antigen contains blood corpuscles mixed with it a powerful isolysin is produced. Haemolysis occurred not only in infected animals which were treated with the serum, but also in a healthy horse, the count falling from 8,000,000 to 2,700,000 quite suddenly. Virulent serum heated to 60° C. for an hour was proved to be without protective properties.

A number of experiments were carried out with goats, pigs, and calves with the object of ascertaining whether any attenuation could be produced by passing the virus through these animals. No evidence of attenuation could be obtained. In the case of the goat and the calf the virulence appeared to be destroyed.

The addition of 2 per cent. carbolic acid to serum was not sufficient to destroy the virus in less than an hour. Chloroform and toluol failed to destroy it even after remaining in contact with it for 20 hours.

The Report contains a summary of the laws and regulations laid down for the control of the disease.

MISCELLANEOUS.

(353) Laveran (A.) & Franchini (G.). **Infections de Mammifères par des Flagellés d'Invertébrés.** [The Infection of Mammals with the Flagellates of Invertebrates.]—*Bull. Soc. Path. Exot.* 1914. July. Vol. 7. No. 7. pp. 605–612. With 4 text figures.

In previous papers (*Compt. Rend. Acad. Sci.*, 1913, September 1st and November 4th, and 1914, March 16th) the authors have published their observations regarding the infection of mice and white rats with

flagellates derived from the dog flea, the rat flea, *Anopheles maculipennis*, and *Melophagus ovinus*.

Natural infections have been observed to take place in the mouse and rat, and it has been found possible to infect mice by causing them to ingest rat fleas containing flagellates.

Figures are given showing the principal forms in which *Herpetomonas ctenocephali* occurs, and it is said that the flagellates of the rat flea differ but little from those of the dog flea. Rounded or leishmania-forms and flagellate forms occur.

In the case of *Crithidia fasciculata*, the flagellate of *Anopheles maculipennis*, crithidial forms generally predominate but, mixed with these, forms possessing all the characters of the genus Herpetomonas are to be found.

The crithidial form also predominates among the flagellates of the intestine of *Melophagus ovinus*.

With whichever of these flagellates the mice or rats are infected the course of the infection is practically the same.

At first the blood is found to contain small oval or rounded intracellular bodies measuring about 2 microns in diameter. The smallest bodies possess only nucleus, but in the larger ones a nucleus and centrosome can be made out. A certain number of these parasites may be observed to be in a state of division.

The " Anaplasma forms " which may be found in the blood of young animals do not appear to be of a parasitic nature.

At a later stage of infection occasional extra-cellular forms may be found. These are fusiform and non-flagellated. They are about five microns in length and possess a nucleus and centrosome.

In a number of cases infection terminates fatally, although parasites are never present in large numbers in these animals. In preparations made from the liver, spleen, and bone marrow free leishmania-like forms predominate. In some preparations from the liver the authors have occasionally observed oval or spherical forms measuring about five microns. In these a nucleus and centrosome can be distinguished, the latter forming the starting point of a flagellum measuring about 12 microns.

Further fresh points are brought forward in the present paper.

Brief details are given of experiments which indicate that it is easy to infect young white mice by allowing them to ingest the faces of rat fleas which contain *Herpetomonas pattoni*.

Endocellular parasites appear in the blood about the third or fourth day, and flagellated parasites a few days later.

Two experiments to infect dogs with the flagellates of the dog flea and the rat flea failed.

A monkey inoculated intraperitoneally with emulsion of the spleen of a mouse infected from rat fleas showed parasites in its blood after about 5 weeks.

In a mouse inoculated with *Crithidia fasciculata* there developed a skin lesion resembling oriental boil, and preparations made from the deep parts of the lesion revealed the presence of leishmania-like bodies. The centrosome of these bodies was rarely bacilliform.

Attempts to cultivate the organisms gave very doubtful results.

The authors conclude that the evidence obtained supports the view that the leishmaniae and the trypanosomes of the vertebrates may have their origin in the flagellates of the invertebrates.

(354) HOLMES (J. D. E.). **Bursati.**—*Memoirs Dept. Agric. in India.* Veterinary Series. 1914. Sept. Vol. 2. No. 5. pp. 119–153. With 5 plates comprising 11 figures.

This memoir is divided into five parts dealing respectively with the following points: History of Bursati; the Identity of Bursati with Leeches, Summer sore, Granular dermatitis, and other skin affections; Clinical characteristics of Bursati; Histology and Etiology of Bursati; and the Treatment of the condition.

There is also included a list of references and a number of plates, some of which are coloured.

The first part gives some dozen brief references to the opinions expressed by various authors at different times during the last century as to the nature of the disease.

Part II. summarises briefly the views of a number of observers regarding the identity or otherwise of bursati with a number of skin diseases occurring in other parts of the world than India.

Part III. The most accurate description of the clinical features of the disease appears to be that published by SMITH (1874 and 1884). SMITH'S account is given at some length and the principal points are the following: The majority of cases occur in the rainy season, but many cases are encountered during the hot weather. The parts generally involved are the angles of the mouth, prepuce, glans penis, fetlocks, and pasterns. The morbid processes start in the subcutaneous tissue. The most distinctive feature of the disease is that it becomes indolent in character, the products of the disease undergoing a peculiar elaboration and remaining as irritants. These products are the so-called "Kunkur stones."

The progress of the formation of a lesion is most easily followed at a place where the skin is thin. There is first of all swelling, and after a few days it is possible to detect that at one point the swelling is becoming harder than elsewhere. This increases in size until it is about the size of a shilling. The skin over the hardened area then becomes thickened and adherent to the tissue beneath. This occurs after about a fortnight. The cuticle is removed either by friction or otherwise and an open sore results. The acute inflammation suddenly disappears and the diseased process becomes an indolent one. The edges of the sore are raised above the surface, are fairly regular and sometimes callous. The ulcerating surface is concave, and situated on and embedded in it are yellowish spherical bodies, which can be pressed out leaving depressions behind. From these depressions a clear liquid exudes. These are the "kunkur bodies."

Although it is common to regard bursati as the result of wound infection, Holmes states that that is not the most common way in which a bursati lesion is started. He is in agreement with SMITH that the lesion is in the first place one of the subcutaneous tissue, and that it is only in the second stage that the skin becomes involved. By the time the skin is lost the underlying tissue has become hard and the surface covered with granulations. In situations where the lesion is not subjected to friction there is little tendency for it to spread, or for the granulations to become very prominent. The surface is dry and sometimes covered with a scab. There may be a

slight serous discharge but, except in old lesions where secondary invasion by pyogenic bacteria has taken place, there is no pus.

Bursati lesions involving mucous membranes are found on the inner canthus of the eye, the angle of the mouth, and the penis. Irregular forms of the disease sometimes occur in which the epidermis is diffusely eroded without any deep-seated lesions being formed.

Holmes has never seen cases of the disease in which there were lesions of the internal organs such as have been described by BURKE, MEYRICK, LINGARD, and others, and he believes that these were cases of mistaken diagnosis.

From the description given it appears that the condition is quite distinct from "leeches," granular dermatitis, summer sores, and other similar skin affections. It is stated that a disease somewhat similar to bursati occurs in America; but there appears to be little doubt that there is some confusion regarding the correct diagnosis of "leeches" and that more than one disease has been described under this name.

In the case of summer sore the calcareous nodules have a very different structure to the kunkurs found in bursati. In summer sore the nodules have an outer covering of fibrous tissue and a central cavity which has a calcified wall.

In bursati the outline of the lesions is not regular, and the kunkur is easily enucleated from the fibrous capsule. The inner mass is hard and fibrous, and is neither caseous nor to any extent calcareous. When pressed between two glass slides it behaves like a hard piece of rubber.

Part IV.—The primary process in the formation of a bursati sore is an area of subcutaneous inflamation due to some specific agent. This irritation, which occurs in a part which has previously had its vitality lowered by some traumatic cause, sets up necrosis of the skin, While this is going on the subcutaneous tissue becomes hard and infiltrated. When the necrotic skin is shed there is left a circular or oval sore with well defined edges. Granulations soon appear in the central part and cause this to become elevated above the surrounding tissues. If such a lesion is kept free from irritation of all kinds it shews little or no tendency to spread, but at the same time no tendency to heal. In debilitated animals, or in cases where the lesion is exposed to irritation, it shews a tendency to spread with the resulting formation of a diffuse tumour in the subcutaneous tissue. The granulations on the surface are very vascular, and pressure causes the expulsion of kunkurs as large as a pin's head or a grain of shot. There is no degeneration of the tissues or pus formation except after invasion with pyogenic bacteria. The deeper fibrous tissue has kunkurs embedded in it and merges gradually into the surrounding tissues.

Microscopical examination of the lesions shews that they are composed of fibrous tissue. In the younger ones there are large numbers of cells of different kinds, and particularly of eosinophiles. In older lesions the fibrous tissue is more dense and giant cells are found. Spaces are found in the sections from which kunkurs have dropped out. These spaces are surrounded by fibrous tissue and in some sections a few pigment-bearing cells may be found. There is no evidence of calification or other form of degeneration.

The author has been unable to find any evidence that the lesions are caused by filarial embryos, as stated by LINGARD. He has,

however, been able to find a fungoid organism which he believes is responsible for the condition.

The most satisfactory method of examination is as follows: Small blocks of the tumours or kunkurs are washed in alcohol, ether, and water, and then macerated in 40 per cent. caustic potash for 16 to 20 hours. A fragment of such material is taken and pressed between two slides. Isolated spore-like bodies and broken strands of mycelia can be found, but they cannot be satisfactorily differentiated from fragments of cells, granules of eosinophiles and tissue fibres. The most convincing pictures are obtained with material from young lesions. In these can be seen groups of spores which on careful examination are found to be double contoured. The organism is difficult to demonstrate by staining, as it does not take the stain well and is easily decolourised.

Cultivation on Sabouraud's agar most constantly yielded a slow-growing fungus. Growth first became evident on the fifth day in the form of a small dry-looking colony. This gradually spread until the whole surface was covered with a white chalk-like substance which was easily removed, leaving a dry opaque skin adhering to the agar. Cultures of this nature were obtained both from bursati tissue and blood from infected horses.

BUTLER found that the fungus most closely resembled *Sporotricum minutissimum*.

All attempts to infect horses, guinea-pigs, and rabbits failed.

Part V.—The treatment of the condition.—For local treatment the lesions must be completely excised, the wounds being treated as ordinary wounds.

In the experimental treatment of bursati some success has been obtained with arsenic either in conjunction with atoxyl or alone, the treatment being carried out after the manner employed for surra. Under this treatment some cases shewed a rapid improvement, while others did not appear to be benefited.

Some such cases shewed rapid recovery when subjected to treatment with biniodide of mercury and potassium iodide, the doses being 5 grains increasing to 20 of the former and 1 to 3 drachms of the latter. Three courses were given of ten to 12 days each with intervals of one week.

HAZELTON recommends that after the diseased tissues have been surgically removed the cavity should be kept constantly dressed with crystalline red oxide of mercury.

Conclusions:

"1. A considerable amount of confusion exists in literature regarding the identity of Bursati in India with 'Leeches' in America, 'Swamp Cancer' in Australia and other affections described as 'Summer Sore,' 'Granular Dermatitis' and 'Parasitic Fibromata,' etc.

"2. The latter affections such as 'Summer Sore,' 'Granular Dermatitis' and 'Parasitic Fibromata,' etc., are held, on the observations of several authors, to be connected with the presence of nematode embryos.

"3. Bursati varies in most clinical aspects from the affections described as 'Summer Sore,' 'Granular Dermatitis' and 'Parasitic Fibromata,' etc.

"4. There is not sufficient evidence to prove that nematode embryos are present in Bursati lesions or that Bursati sores or tumours are caused by such embryos.

"5. There is a similarity in several clinical aspects between 'Leeches' and Bursati.

"The presence of a fungus in 'Leeches' has been recorded by several observers and described as the causal agent. The spores and mycelia of a somewhat similar fungus are frequently found in the kunkur and tumours of Bursati.

"6. The presence of spores and mycelia in the Bursati tumours, and the fact that the cultures of a fungus of the genus Sporotricum have repeatedly been obtained from the Bursati tumours and kunkurs and also direct from the blood of horses infected with Bursati, affords some evidence that the disease is a mycosis somewhat resembling the Sporotricosis of the horse and mule described by CAROUGEAU in Madagascar."

The paper includes 5 plates comprising 11 figures, shewing the appearance of lesions, spores, and mycelia, and cultures.

(355) HOLMES (J. D. E.) **Some Experiments on the Immunising Effect of the Simultaneous Injection of an Anthrax Attenuated Virus and an Anthrax Anti-serum.**—*Memoirs Dept. Agric. India.* Veterinary Series. 1914. Sept. Vol. 2. No. 7. pp. 199–206.

The experiments recorded in this paper were carried out in order to obtain information regarding the risks attaching to the use of attenuated cultures for the vaccination of animals against anthrax.

Vaccines were prepared by the various known methods, and were tested upon rabbits, guinea-pigs, and sheep, but with none of them was it possible to exclude mortality due to the inoculation. This was especially the case with the sheep. In some cases death from anthrax occurred as late as 20 days after inoculation, the virus apparently regaining its full virulence in the bodies of the animals.

Indian cattle, although susceptible to natural infection by ingestion, are very resistant to experimental inoculation, and therefore cannot be used for testing sera and vaccines.

In the first experiment a number of guinea-pigs, rabbits, sheep, and ponies were inoculated with broth cultures which had been incubated at 37° C. for 48 hours and then heated at 80° C. for one hour. This vaccine was administered in doses of 0·25 to 1 cc. to guinea-pigs and rabbits, 1 to 5 cc. to sheep, and 5 cc. to ponies. Four rabbits were used, and one which received the smaller dose died. Similarly, one guinea-pig out of three used died. Four sheep out of 12 succumbed, but all the three ponies used survived. The unheated culture proved fatal to three sheep in doses of 0·025 cc.

In the second series of experiments a number of sheep were inoculated with 5 cc. of this vaccine and simultaneously with doses of 5 to 25 cc. of a protective serum, which was of such strength that 20 cc. was protective for sheep against inoculation with virulent anthrax. Two of the sheep died in about a week. The surviving five animals were inoculated after eight weeks with 0·025 cc. of virulent culture. All survived.

In the second series of experiments of the same nature 12 sheep received a full dose of protective serum with 1 cc. of vaccine. Two of these died in nine days. One died when the immunity was tested eight weeks later, and one more died when again tested after a further interval of six weeks.

A third series of eight sheep were subjected to a similar experiment, save that the dose of vaccine was 5 cc. All survived the vaccination, but three died within five days when their immunity was tested after an interval of eight weeks.

Tests on ponies.—Eight ponies, ranging from 300 to 400 lb. body weight, were given from 15 to 50 cc. of serum and 5 cc. of vaccine. None died. After eight weeks two succumbed to inoculation with 0·025 cc. of virulent anthrax culture within nine days. Two showed temperature reactions, but lived.

In this experiment one of the three virus control ponies survived.

Five donkeys survived vaccination with 25 cc. of serum and 5 cc. of vaccine, but one died in five days when their immunity was tested with 0·5 cc. of virus after an interval of eight weeks.

Five sheep were inoculated with 5 cc. of vaccine alone. On being tested with 0·025 cc. of virus after an interval of three weeks, all died within three days.

Conclusions :—

"1. The method of immunisation against anthrax by means of the simultaneous injection of serum with the inoculation of an attenuated culture is not free from risk. A varying number of inoculation mortalities follow.

"2. Sero-vaccination confers an active immunity. It does not, however, protect in all cases treated, and the results are variable.

"3. An inoculation of the vaccine alone did not confer any immunity.

"4. The use of an attenuated culture in combination with anti-serum does not appear to be a method in any way superior to the combination of a virulent culture with anti-serum. Following both methods a varying percentage of mortalities from Anthrax occurs, and although an active immunity is produced in the animals which do not succumb, this immunity does not extend to all cases, and a certain number of animals remain susceptible to Anthrax infection."

(356) CUMMINS (S. L.), COPPINGER (C. J.) & URQUHART (A. L.). **Further Observations on the Presence of Antibodies for *Micrococcus melitensis* in the Milk of English Cows.**—*Jl. Royal Army Med. Corps.* 1914. July. Vol. 23. No. 1. pp. 36–41.

In the *Journal of the Royal Army Medical Corps* for January 1914, KENNEDY drew attention to the fact that the sera of five out of 22 English cows examined contained agglutinins for the *Micrococcus melitensis*. The milk of three of these animals gave positive results in high dilutions, and the whey obtained from these milks yielded results exactly similar to those given by the milks. Filtration of the milk or whey appeared to diminish the agglutination. BASSETT-SMITH found one sample of milk out of a number examined which caused agglutination of the organism in dilutions up to 1 in 100. Attempts to cultivate the micrococcus from the milk failed in every case.

These results are of the greatest importance because, if further investigation shows that the reaction is not connected with infection with the organism, the value of the test in the detection of infected goats will have to be reconsidered. If there is found to be a connection between the reaction and infection of English cattle, the question of the infection of the milk will acquire great importance.

The agglutination of the micrococcus by cow's milk has already been observed in Gibraltar, this having been recorded by HORROCKS in 1907. The infection of cows was also referred to in the Report of the Commission on Malta Fever, Part 1, in 1905.

The present paper records the results obtained during the examination of the milk of seven cows, two of which gave positive results.

One of these yielded milk which agglutinated the micrococcus in dilutions varying from 1 in 250 to 1 in 1,000 on different dates.

It was ascertained that a degree of acidity many times higher than that of milk does not cause agglutination of the organism, and that therefore acidity is not a factor in the production of the agglutination.

The milk, whey, and blood serum of the cow all agglutinated the organism to corresponding dilutions. The agglutinin were demonstrable in the milk when tested almost immediately after drawing.

It was also found that heating either the milk, whey or serum to 57° C. for 25 minutes did not destroy the agglutinin, but that the optimum concentration of the agglutinating substance was moved to higher dilutions by heating; thus paradoxal results were obtained. Such paradoxal results were not obtained with unheated milk. This effect was most marked with the blood-serum.

The milk failed to agglutinate *B. typhosus*, *coli*, *dysenteriae*, and *M. paramelitensis*. The whey did not lose its agglutinating power after being kept for three weeks.

In one experiment the passage of diluted whey (1 in 12) through a Doulton filter retarded, but did not eliminate, the agglutinin. The serum of an immune rabbit diluted to the same degree when passed through a filter lost none of its agglutinating power. The rabbit serum when diluted with the whey from the cow and filtered still agglutinated to the same degree, but when whey from a control cow was added complete removal of the agglutinins resulted. These observations are to be repeated, as filters appear to differ in their power of arresting agglutinins.

The milk, whey, and serum of this cow all contained thermo-stable opsonins for the organism. The opsonin was present in large amounts, and was demonstrable in high dilutions. In dilutions up to 1 in 40 the number of cocci per cell were too numerous to allow of accurate enumeration, while with the control serum the number per cell in dilutions from 1 in 5 to 1 in 320 was about 0·5.

Opsonin was still demonstrable after the whey had been kept for three weeks.

The authors have not been able to demonstrate the presence of deviating substances in the heated milk or whey.

In one experiment the heated serum was able completely to deviate two minimum haemolytic doses of complement up to a dilution of 1 in 16. The dilutions were not carried further. In a second experiment no deviation was obtained, but in this instance the serum had been kept diluted with saline for several days, and a positive rabbit serum also yielded negative results when treated in the same way.

The conclusion drawn is:—

The milk, whey, and blood serum of Cow 5 behaves towards *M. melitensis* in a manner comparable to the body-fluids of animals suffering from, or immunised against, this organism, due allowance being made for differences in concentration of "anti-substances" and degrees of immunity.

REPORTS.

(357) Hutchens (E.). **Annual Report of the Department of Agriculture. Uganda Protectorate. Year Ending March 31st 1914. Report of the Veterinary Department.** pp. 28–35. 1914. Kampala. The Uganda Printing and Publishing Company, Ltd.

Rinderpest.—During the year this disease has occurred for the first

time in a district west of the Nile, but up to the time of writing it had been confined to within 25 miles of the river and to the south of the Jinja-Kampala road.

Fifteen cases of the disease were treated by RICHARDSON with permanganate of potash on the lines suggested by WALKER [see this *Bulletin*, Vol. i. No. 2, p. 127.] The results were most hopeful and warrant an extended trial of the method in the treatment of individual cases.

Foot and mouth disease.—The disease is well-known in the Protectorate, but except in neglected cases in transport animals it is not responsible for serious losses.

Trypanosomiasis.—It has been proved by Miss ROBERTSON that *G. morsitans* is the transmitting agent of *T. pecorum* in Uganda. A number of hitherto unrecorded *morsitans* areas have been discovered, among which are Buruli, and two areas in Southern Ankole.

T. nanum was found in a donkey brought down from the Northern Province, and after three months' treatment (method not given), it appeared to have recovered. Trypanosomes of the *T. brucei* type were found in an Egyptian donkey and in a mule. Both animals died, the disease running a rather acute course.

Piroplasmosis in dogs has a wide distribution, but cases met with are seldom fatal if treated with trypanblue.

No cases of rabies have been found.

(358) BEVAN (Ll. E. W.). **Report of the Veterinary Bacteriologist, Southern Rhodesia for the Year 1913.** f'cap. 3 pp.

During the year under review little or no research work has been done, as Bevan was on vacation leave for eight months.

African Coast Fever.—Several outbreaks of this disease occurred. In some instances the circumstances were difficult of explanation. In more than one instance a single case cropped up, generally in a young animal. In other cases outbreaks occurred on old infected areas which according to the accepted theories should have long since been clean. One explanation offered is that an endemic form of the disease allied to the condition known as amakebe in Uganda exists in the Territory. Another is that recovered animals may act as reservoirs of infection.

Anaplasmosis has acquired an increased importance during the year. Not only has it been responsible for a number of deaths among imported animals, but it causes very severe losses in growth and development, which render it one of the greatest handicaps to stock raising. The resistance to the disease possessed by indigenous animals decreases when these are improved by crossing with imported animals, and as the breeding-up extends the disease will acquire more and more importance.

While redwater, the disease with which anaplasmosis is generally associated, is amenable to treatment with trypanblue, anaplasmosis has resisted all methods of treatment tried up to the present.

During the year, 94 animals imported from Great Britain were inoculated, and of these 27 died. In one instance 16 died out of a batch of 33. The deaths took place between the 35th and the 40th day after inoculation. The animal that was the source of the blood

for inoculation was a standard animal which had previously yielded a comparatively mild virus, but on examination its blood was found to contain spirochaetes in addition to anaplasms and piroplasms. It appears to be probable that this infection was acquired naturally through the medium of tick-infested bedding.

A number of experiments were carried out in connection with the immunisation of horses against horse sickness, and the results were considered to be very satisfactory when the animals were tested with very large doses of a certain virus. Unfortunately the animals had to be sold and all trace of many of them was lost, but there is no doubt that under careless management many of them died of the disease. The results, in those cases in which the animals could be followed, indicated that immunisation of an animal against one strain of the virus does not protect against all strains.

A heavy trypanosome infection occurred among trek oxen working in the " fly " area in the Hartley district, but good results were obtained with treatment (method not given). Treatment in pigs has not been successful.

A trypanosome identified by BRUCE as *T. caprae* has been found in the blood of a sheep from Mafungabusi and also in an ox in the Gatooma district.

RECENT LITERATURE.

[Continued from this *Bulletin* Vol. 2, No. 3, pp. 154–156.]

Anaplasmosis and Babesiasis.

(359) TIBADI (Ettore). Forme di Anaplasma nel Sangue di Diversi Animali in Sardegna. [Types of Anaplasma in the Blood of Various animals in Sardinia].—*Pathologica.* 1914. May 15. Vol 6. No. 133, pp. 261–264. With 1 text fig.

(360) VALLADARES (J. F.). Equine Biliary Fever in Madras.—*Parasitology.* 1914. May. Vol. 7. No. 1, pp. 88–94.

Rabies.

(361) NICOLLE (C.). La Rage en Tunisie pendant l'Année 1913. [Rabies in Tunis during the year 1913.]—*Arch. Inst. Past. Tunis,* 1914. Aug. 1. Vol. 9. No. 1, pp. 60–61.

Snake Bite.

(362) ACTON (H. W.) & KNOWLES (R.). Studies on the Treatment of Snake-Bite. Parts I, II and III.—*Indian Jl. Med. Research,* 1914. July. Vol. 2. No. 1, pp. 46–148. With 5 plates and 3 charts.

(363) BANNERMAN (W. B.). Report on the Treatment of Snake-Bite with Potassium Permanganate.—*Indian Jl. Med. Research,* 1914. July. Vol. 2. No. 1. pp. 149–182.

Spirochaetosis.

(364) CARPANO (Matteo). Ueber einige in papillomatösen Neubildungen bei Pferden aufgefundene Spirochäten. [Spirochaetes found in Papillomatous Tumours in Horses.]—*Centralbl. f. Bakt.* 1 Abt. Orig. 1914. July 25. Vol. 74. No. 7, pp. 584–591. With 1 plate and 18 text figs.

(365) WOLBACH (S. B.) & BINGER (C. A. L.). The Cultivation of a Free living Filterable Spirochaete (*Spirochaeta elusa:* New Species). A Preliminary Report.—*Jl. Med. Research.* 1914. Mar. Vol. 30. No. 1. pp. 9–22. With 3 plates comprising 18 figs.

(366) WOLBACH (S. B.) & BINGER (C. A. L.). Notes on a Filterable Spirochaete from Fresh Water. *Spirochaeta biflexa* (New Species).—*Jl. Med. Research.* 1914. Mar. Vol. 30. No. 1. pp. 23–25. With 1 plate comprising 15 figs.

Tick Paralysis.

(367) NUTTALL (G. H. F.). "Tick Paralysis" in Man and Animals. Further published Records, with Comments.—*Parasitology,* 1914. May. Vol. 7. No. 1, pp. 95–104.

Trypanosomiasis.

(368) LAFONT (A.) & DUPONT (V.). Sur les Résultats éloignés du Traitement de la Maladie du Sommeil par le Ludyl et le Galyl. [The Results of the Treatment of Sleeping Sickness by Ludyl and Galyl after considerable Intervals.]—*Bull. Soc. Path. Exot.* 1914. July. Vol. 7. No. 7, pp. 640–647.

Biting Flies.

(369) CUMMINGS (B. F.). Descriptions of five new Species of Anoplura and Mallophaga.—*Bull. Entomol. Research*, 1914. Sept. Vol. 5. No. 2, pp. 155–177. With 8 text figs.

(370) EDWARDS (F. W.). New Culicidae from Borneo and Hong Kong.—*Bull. Entomol. Research.* 1914. Sept. Vol. 5. No. 2, pp. 125–128.

(371) GOUGH (L. H.). Preliminary Notes on Egyptian Mosquitos.—*Bull. Entomol. Research.* 1914. Sept. Vol. 5. No. 2, pp. 133–135.

(372) MANSION (G.). Les Phlébotomes européens. [The European Phlebotomi.]—*Bull. Soc. Path. Exot.*, 1914. July. Vol. 7. No. 7, pp. 584–590. With 7 text figs.

(373) MARZINOWSKY (E. I.). De l'Existence de *Stegomyia fasciata* (*St. Calopus*) en Russie. [The Occurrence of *Stegomyia fasciata* in Russia.]—*Bull. Soc. Path. Exot.*, 1914. July. Vol. 7. No. 7, pp. 590–593.

(374) ROPER (R.). An Account of Some Anopheline Mosquitos found in British North Borneo, with Description of a New Species.—*Bull. Entomol. Research*, 1914. Sept. Vol. 5. No. 2, pp. 137–148. With 2 maps and 1 text-fig.

(375) STANTON (A. T.). The Anopheles of Malaya. Part II.—*Bull. Entomol. Research*, 1914. Sept. Vol. 5. No. 2, pp. 129–132. With 2 text-figs.

Helminths.

(376) PERRONCITO (E.). Nota sul Gastrodiscus. [Notes on Gastrodiscus].—*Giorn. R. Accad. Med. di Torino*, 1914. May–June. Vol. 77. No. 5–6, pp. 168–169.

(377) PERRONCITO (E.). Bronco-polmonite verminosa in Africa. [Verminous Broncho-Pneumonia in Africa].—*Giorn. R. Accad. Med. di Torino*, 1914. May–June. Vol. 77. No. 5–6, p. 170.

(378) ROMANOVITCH (M.). Microfilaire des Chevaux atteints de Boutons Hémorragiques. [Microfilaria in Horses affected with Haemorrhagic Dermatitis].—*Compt. Rend. Soc. Biol*, 1914. July 24. Vol. 77. No. 26, pp. 390–391.

(379) SAUNDERS (P. T.). Notes on some Parasites of Live Stock in the West Indies.—*West Indian Bull.*, 1914. Vol. 14. No. 2, pp. 132–138.

(380) SEURAT (L.-G.). Sur un Nouveau Spiroptère du Chat Ganté. [A New Spiroptera of *Felis ocreata* Gmel.]—*Compt. Rend. Soc. Biol.*, 1914. July 17. Vol. 77. No. 25, pp. 344–347. With 5 text figs.

(381) WEISS (A.). Note sur les Microfilaires du Rat à Trompe. [The Microfilariae of the Elephant-Shrew.]—*Arch. Inst. Past. Tunis*, 1914. Aug 1. Vol. 9. No. 1, pp. 50–51.

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(382) MARTINI. (E). Ueber die Entwickelung von Malariaparasiten in Bassschen Nährboden [The Development of Malarial Parasites in Bass's medium]—*Centralbl f. Bakt.* I. Abt. Orig. 1914. June 13. Vol. 74. No. 3–4, pp. 250–254. With 2 coloured plates and 1 text fig.

(383) COLES (A. C.). Blood Parasites found in Mammals, Birds, and Fishes in England.—*Parasitology*, 1914. May. Vol. 7. No. 1, pp. 17–61. With 4 plates.

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TROPICAL DISEASES BUREAU,
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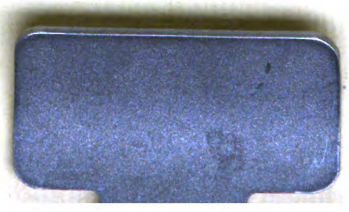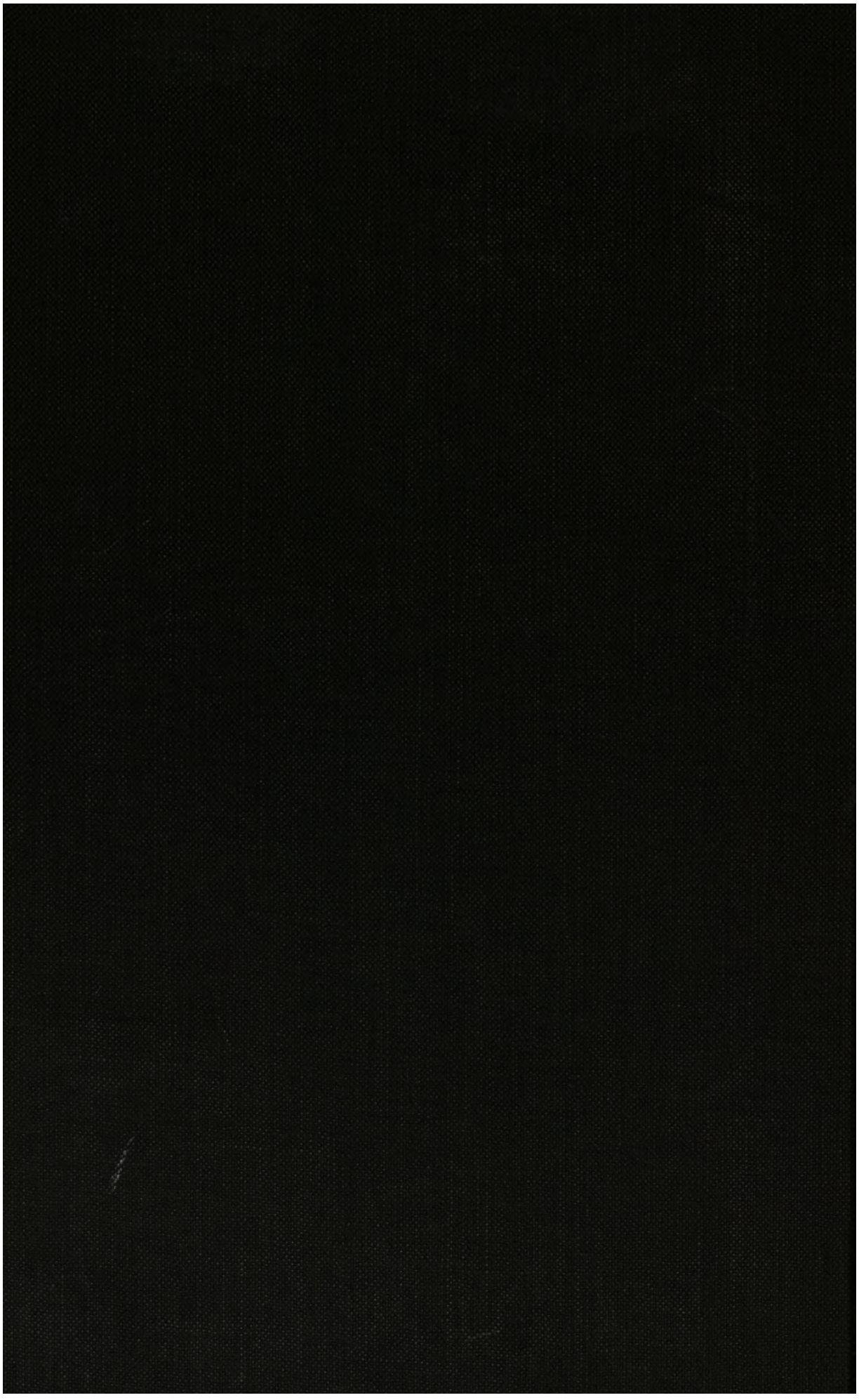
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